



IMPERIAL AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE ANNALS COMBINED WITH LONDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY')

CONDUCTED BY

SIR A. SMITH WOODWARD, LL.D., F.R.S., F.G.S.,

SIR GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.,

C. TATE REGAN, M.A., D.Sc., F.R.S.,

JOHN STEPHENSON, C.I.E., M.B., D.Sc., F.R.S.,

AND

W. T. CALMAN, D.Sc., F.R.S.

VOL. XL.—TENTH SERIES.

LONDON:

PRINTED AND PUBLISHED BY TAYLOR AND FRANCIS.

1933.

"Omnes res creatæ sunt divins sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientiæ* Domini; ex œconomiâ in conservatione, proportionè, renovatione, *potentiâ* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1787.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



CONTENTS OF VOL. XI.

[TENTH SERIES.]

NUMBER 61.

	Page
I. New <i>Curculionidae</i> (Col.) from the Belgian Congo. By Sir GUY A. K. MARNHALL	1
II. On the Cynodont Reptile <i>Thrinaxodon kirkinus</i> Seeley. By F. R. PARRINGTON, M.A., Assistant Superintendent of the University Museum of Zoology, Cambridge	16
III. New African Species of the Dipterous Genus <i>Paralimna</i> (Ephydriidae). By EZRA T. CRESSON, Jr., The Academy of Natural Sciences of Philadelphia	24
IV. New <i>Limantriidae</i> (Lepidoptera Heterocera) in the British Museum Collection. By C. L. COLLINETTE. (Plate I.)	33
V. Descriptions and Records of Bees.—CXL. By T. D. A. COCKERELL, University of Colorado	49
VI. The Taxonomy of <i>Lyperosia exigua</i> De Meijere (Diptera, Muscidae). By I. M. MACKERRAS, B.Sc., M.B., Ch.M., Commonwealth Council for Scientific and Industrial Research, Canberra ..	58
VII. Notes on <i>Gammarus zaddachi</i> Sexton from Essex, with Observations on Eye-variations in this Species. By RICHARD PALMER, Dept. of Zoology, University College, London	64
VIII. Note on the Occurrence of Sponge-spicules associated with the iron-ores of North Wales. By WILLIAM PULFREY, M.Sc., Ph.D. (Plate II.)	67
IX. On a new Palaeoniscid Genus from Madagascar. By JAMES BROUGH. (Plate III.)	76
X. A Collecting-trip in Switzerland. By MARTIN E. MOSELY, F.E.S.	87
XI. Miocene Primates from British East Africa. By A. TINDELL HOPWOOD, M.Sc., F.L.S., Department of Geology, British Museum (Natural History)	96
XII. Papers on Oriental <i>Carabidae</i> .—XXVII. By H. E. ANDREWS	99
XIII. The Nematode Genus <i>Ascarophis</i> van Beneden. By H. A. RAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History)	111

	Page
XIV. New Triassic Palæoniscids from Madagascar. By ERROL IVOR WHITE, Ph.D., F.G.S., Assistant Keeper, British Museum (Nat. Hist.)	118
XV. The Tachinid Genus <i>Doddiana</i> Curran (Diptera). By JOHN R. MALLOCH	128
XVI. Notes on certain Species of the Genus <i>Orthellia</i> , with a Description of One new Species. By DAPHNE AUBERTIN, M.Sc., F.L.S.	139
XVII. A few new Melolonthine Coleoptera from Mexico. By GILBERT J. ARROW	145
XVIII. Some Amphibians and Reptiles from the Lesser Antilles. By H. W. PARKER, B.A.	151
XIX. On the Decapod Crustacean <i>Eger lævis</i> (Blake). By THOMAS H. WITHERS, F.G.S., of the British Museum (Nat. Hist.). (Plate IV. figs. 1-3.)	159
XX. The Machæridian <i>Lepidocoleus kotleyanus</i> (Reed ex Salter MS). By THOMAS H. WITHERS, F.G.S., of the British Museum (Nat. Hist.). (Plate IV. fig. 4.)	162
<i>New Book</i> :—The Nidification of the Birds of the Indian Empire.	
By E. C. STUART BAKER, C.I.E., O.B.E., F.Z.S., &c. Vol. I.	164
A Vote on some Echinoderia Names. By F. A. BATHER	168

NUMBER 62.

XXI. New Species and Subspecies of <i>Arctiina</i> . By Lord ROTHSCHILD, Ph.D., F.R.S.	167
XXII. Descriptions of Three new Species of <i>Formicula</i> , and a Synonymical Note. By HORACE DONISTHORPE, F.Z.S., F.E.S., &c.	194
XXIII. <i>Tarsonemus approximatus</i> Banks var. <i>narcissi</i> Ewing: a Variety of Tarsonemid new to the British List. By A. M. MASSEE (Research Station, East Malling, Kent)	198
XXIV. A new Species of Gall-mite from South India. By A. M. MASSEE (Research Station, East Malling, Kent). (Plate V.)	201
XXV. Descriptions and Records of Bees.—CXLI. By T. D. A. COCKERELL, University of Colorado	204
XXVI. Notes on Flatfishes (Heterosomata).—IV. A Synopsis of the Genera of the Subfamily <i>Pleuronectina</i> . By J. R. NORMAN, of the British Museum (Nat. Hist.)	214
XXVII. On <i>Tenustrongylus cynictis</i> , gen. et sp. n., a Trichostrongylid parasitizing the Yellow Mungoos (<i>Cynictis penicillata</i>). By P. L. LENOUX, R.Sc., M.R.C.V.S., Central Research Station, Mazabuka, Northern Rhodesia	222

	Page
XXVIII. Notes on Myriapoda.—XXXIV. A rare English Centipede, <i>Lithobius borealis</i> Meinert. By HILDA K. BRADY-BIRKS, M.Sc., M.B., Ch.B., L.R.C.P., M.R.C.S., D.P.H., and the Rev. S. GRAHAM BRADY-BIRKS, D.Sc., F.Z.S.	228
XXIX. Relationships and Habitat of <i>Troodon</i> and the <i>Nodosaurus</i> . By C. M. STERNBERG	231
XXX. Report on a small Collection of Sponges from Stil Bay, S. Africa. By MAURICE BURTON, M.Sc., Assistant-Keeper, Department of Zoology, British Museum (Natural History)	235
XXXI. A new Genus and Species of the Family <i>Myrmeleonidae</i> . By D. E. KIMMINS. (Plate VI.).....	244
XXXII. Three new Species of the Genus <i>Dericorys</i> Serv. (Orthoptera, <i>Acrididae</i>). By B. P. UVAROV	247
XXXIII. A new Gecko of the Genus <i>Gymnodactylus</i> from New Guinea. By L. D. BRONGERSMA, 's Rijks Museum van Natuurlijke Historie, Leiden	252
The Nidification of the Birds of the Indian Empire. By E. C. STUART BAKER	254

NUMBER 63.

XXXIV. The Relation between Somatic and Germ Cells in the asexually produced Polyps of the Polyzoon <i>Alcyonidium gelatinosum</i> . By G. H. FAULKNER, D.Sc. (Plates VII. & VIII.)	255
XXXV. On the Taxonomic Value of the Subgenus <i>Lophomops</i> (Nyctinominae Bats), with Remarks on the Breeding Times of African Bats. By F. WIMPFEN BRÆSTRUP, Copenhagen.....	269
XXXVI. The <i>Micrasema</i> Species (Trichoptera) of the French Pyrenees. By MARTIN E. MOSELY, F.E.S.	274
XXXVII. Notes on the Biology of Spiders.—VIII. Rare Spiders and the Meaning of the Word "rare." By W. S. BRISTOWE, M.A., F.Z.S.	279
XXXVIII. Notes on the Biology of Spiders.—IX. The British Species of <i>Atypus</i> . By W. S. BRISTOWE, M.A., F.Z.S.	289
XXXIX. <i>Diplostomum azimi</i> , sp. n., a new Trematode Parasite of the Dog. By NAZMI GOHAR, M.R.C.S. Eng., L.R.C.P. Lond., Assistant Lecturer in Parasitology, Faculty of Medicine, Cairo....	302
XL. Reports on the Percy Sladen Expedition to some Rift Valley Lakes in Kenya in 1929.—V. Copepods from the Rift Valley Lakes in Kenya. By A. G. LOWMEKE	307
XLI. A Contribution towards a Knowledge of the Thysanopterous Genus <i>Haplothrips</i> Serv. By RICHARD S. BAGNALL, D.Sc., F.R.S.E.	313

	Page
XLII. The Lechwe of South-Central Africa. By EDGAR N. BARCLAY	384
XLIII. The Genus <i>Calopa</i> Meigen (Diptera, Cœlopidae). By JOHN R. MALLOCH	339
XLIV. Entomological Expedition to Abyssinia, 1926-7. Hymenoptera, II.: <i>Sphagida</i> and <i>Psammocharida</i> . By GEORGE ARNOLD, D.Sc. With an Introductory Note and Supplementary List by HUGH SCOTT, Sc.D.	851
XLV. Descriptions and Records of Bees.—CXLII. By T. D. A. COCKERELL, University of Colorado	372
XLVI. The Genus <i>Uroxys</i> (Coleoptera, Copridæ), with Descriptions of some new Species. By GILBERT J. ARROW	385
XLVII. Papers on Oriental <i>Curabida</i> .—XXVIII. By H. E. ANDREWES	399
XLVIII. Two new Species of the Nematode Genus <i>Mermis</i> . By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History)	413
Obituary Notice:—Lt.-Col. JOHN STEPHENSON, C.I.E., F.R.S.	421
New Book:—Australian Finches in Bush and Aviary. By NEVILLE W. GATLEY	422

NUMBER 64.

XLIX. Principles in the Classification of the <i>Spiriferida</i> . By T. NEVILLE GEORGE, D.Sc., Ph.D., F.G.S.	423
L. Descriptions and Records of Bees.—CXLIII. By T. D. A. COCKERELL, University of Colorado	456
LI. <i>Kingdonella wardi</i> , gen. et sp. n., a new Grasshopper (Orthoptera, <i>Acrididae</i>) from the Assam Himalayas. By B. P. UVAROV, British Museum (Natural History)	468
LII. Further Coleoptera from the Galapagos Archipelago. By K. G. BLAIR, B.Sc., F.E.S., Deputy Keeper of the Department of Entomology, British Museum (Natural History)	471
LIII. Notes on a Collection of Polychæta from South Africa. By C. C. A. MONRO (British Museum)	487
LIV. Notes on the Biology of Spiders.—X. British Cellar Spiders, with the Description of a Species new to Britain. By W. S. BRISTOWE, M.A., F.Z.S.	509
LV. A new Genus and Species of <i>Anthocorida</i> (Hemiptera) from New Zealand. By W. E. CHINA, M.A.	514
New Book:—Textbook of Palæontology. By KARL A. VON ZITTEL. Translated and edited by CHARLES R. EASTMAN, Ph.D. Vol. II. Second English edition, revised, with additions, by Sir ARTHUR SMITH WOODWARD, F.R.S.	518

NUMBER 65.

	Page
I.VI. Some Upper Carboniferous Brachiopods from Brazil. By F. R. COWPER REED, Sc.D., F.G.S., Sedgwick Museum, Cambridge. (Plate IX.)	519
LVII. The Genus <i>Pseudoleptocerus</i> Ulmer (Trichoptera). By MARTIN E. MOSELY, F.E.S. (Plate X.)	537
LVIII. African Bees of the Genus <i>Cachoxys</i> . By T. D. A. COCKERELL, University of Colorado	547
LIX. Tanaidacea and Isopoda collected by the Great Barrier Reef Expedition, 1928-29. By HERBERT M. HALE, Director, South Australian Museum	557
LX. On <i>Anthracocharis scotica</i> (Poach), a Fossil Crustacean from the Lower Carboniferous. By W. T. CALMAN, D.Sc., F.R.S., Keeper of Zoology, British Museum (Natural History)	562
LXI. New Species of Heterocera in the National Museum, Washington. By W. SCHAUSS	566
LXII. New <i>Pyrrhocoridae</i> in the Collection of the British Museum (Natural History). By Dr. H. C. BLÖRK, 's Rijks Museum Van Natuurlijke Historie, Leiden	568
LXIII. A new <i>Sphingonotus</i> from Morocco (Orthoptera, <i>Acrididae</i>). By B. P. UVAROV	602
LXIV. Description of a new Characid Fish of the Genus <i>Stethaprion</i> from the Lower Amazon. By GEORGE S. MYERS, Stanford University, California	604
LXV. New Argentine <i>Hispinae</i> . By S. MAULIK	605
LXVI. A new Species of Avian Cestode from India. By N. B. INAMDAR, B.Sc., Zoology Department, College of Science, Nagpur, C.P., India	610
<i>New Book</i> :—What Butterfly is That? By G. A. WATERHOUSE ..	613

NUMBER 66.

LXVII. On a Collection of Nematodes from Malayan Reptiles. By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History)	615
LXVIII. On a Primitive Dipnoan from the Middle Devonian Rocks of New South Wales. By EDWIN SHERBON HILLS, Ph.D.(Lond.). Lecturer in Geology in the University of Melbourne. (Plates XI. & XII.)	634
LXIX. Two new Species of Cheliferinea (<i>Pseudoscorpionidae</i>). By Dr. M. BEIER, Vienna	644

	Page
LXX. Contributions towards a Knowledge of the European Thysanoptera.—IV. By RICHARD S. BAGNALL, D.Sc., F.R.S.E. . .	647
LXXI. <i>Osmundites</i> from Central Australia. By W. N. EDWARDS, British Museum (Natural History)	661
LXXII. Notes on new and little-known Orthoptera from Palestine. By B. P. UVAROV, British Museum (Natural History) .	668
LXXIII. On a new Species of Polychæte of the Genus <i>Pilargis</i> from Friday Harbour, Washington. By C. C. A. MONRO (British Museum)	673
LXXIV. The <i>Coccidæ</i> of New Caledonia. By F. LAING, M.A., B.Sc.	675
LXXV. Descriptions and Records of Boes.—CXLIV. By T. D. A. COCKRELL, University of Colorado	678
LXXVI. Coléoptères nouveaux. Par M. PIC	686
LXXVII. A Note on the Subgenus <i>Syrdenus</i> Chaud. (Coleoptera, <i>Carabidæ</i>). By V. LUTSHNIK	689
Index	691

PLATES IN VOL. XI.

PLATE	I.	New Lymantriidæ.
	II.	Spicules of <i>Pyritonema minuta</i> and <i>Reniera</i> (?).
	III.	<i>Diaphorognathus gillioti</i> .
	IV.	<i>Æger</i> and <i>Lepidocoleus</i> .
	V.	<i>Pongamia glabra</i> (healthy and affected leaves).
	VI.	<i>Pseudimares iris</i> , sp. n., ♂.
	VII. }	Asexual reproduction in <i>Alcyonidium</i> .
	VIII. }	
	IX.	Upper Carboniferous Brachiopods from Brazil.
	X.	Anterior wing of <i>Pseudoleptocerus njalensis</i> , sp. n.
	XI.	<i>Dipnorhynchus süsamilchi</i> .
	XII.	1 & 2. <i>Epiceratodus forsteri</i> . 3. <i>Dipterus tuberculatus</i> . 4. <i>Dipnorhynchus süsamilchi</i> .

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

"..... perlitorea spargito muscum,
 Naiades, et circum vitreos considite fontes.
 Pollice virgineo teneros hic carpite flores
 Floribus et pictum dives repleta canistrum
 At vos, o Nymphæ Craterides, ite sub undas
 Ita, recurvato variata corallia trunco
 Vellite musconis e rupibus et mithi conchas
 Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenus (Lamachus) 1 col 1

No. 61. JANUARY 1933.

I.—*New Curculionidæ (Col.) from the Belgian Congo.*

By Sir GUY A. K. MARSHALL.

DURING recent years Mr. J. Ghesquière has kindly sent me from the Belgian Congo a number of weevils which he has reared from the larval stage, or of which he has observed the food-plants. Among these were several new species, which are here described; the types will be deposited in the British Museum, and, where available, cotypes are being sent to the Musée du Congo Belge, Tervueren.

Subfamily ANTHONOMINÆ.

Genus *ENDÆUS* Schönh., 1826.

Nychiomma Pascoe, Journ. Linn. Soc., Zool. xi. 1872, p. 456 (n. syn.).
Endæopsis Champion, Trans. Linn. Soc., Zool. (2) xvi. 1914, p. 437
 (n. syn.).

Nychiomma testacea Pasc., from Borneo, is undoubtedly congeneric with the African species of *Endæus*. Champion states that his genus *Endæopsis* must come near *Endæus*,

Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 1

but gives no characters for distinguishing the two genera, and I am unable to find any.

Endæus baikieæ, sp. n.

♂. Colour flavous to red-brown.

Head almost impunctate, with fine sparse recumbent hairs, and a shallow frontal fovea; eyes very prominent. *Rostrum* as long as the pronotum, gently curved, longitudinally strigose, with a smooth median stripe which is broad in front and narrows to a point at the base. *Antennæ* with joint 2 of the funicle nearly as long as 1, the remainder somewhat transverse, closely approximated, and scarcely widening distally; the club somewhat compressed. *Prothorax* much broader than long, rounded at the sides, widest slightly behind the middle, arcuate at the base, which is wider than the apex; the dorsum with rather shallow, widely spaced punctures, and a low narrow median costa, with transversely recumbent golden hairs and short erect setæ. *Elytra* broadly ovate (11:8), nearly twice as broad as the prothorax, gently rounded at the sides, widest a little behind the middle, broadly rounded at the apex; the striae closely punctate, the punctures somewhat smaller behind; the intervals almost flat, finely aciculate, thinly clothed with short recumbent hairs, each with a single row of short suberect setæ, which on the lateral intervals arise from minute granules. *Legs*: front femora with a large triangular tooth, with the usual row of stiff erect setæ beyond it, the posterior pairs with a much smaller tooth and a fringe of hairs below it; the front tibiae sinuate in the basal half, the apical half less dilated than usual, scarcely carinate on the inner edge.

Length 2.2 mm., *breadth* 1.0 mm.

BELGIAN CONGO: Komi, Sankuru, 3 ♂♂, bred from larvæ found in flower-buds of *Baikiea*, xi. 1930 (*J. Ghesquière*).

Endæus fuscirostris, sp. n.

♂. Flavous, with the rostrum fuscous to red-brown.

Head coarsely punctate, with fine sparse recumbent hairs; no frontal fovea; eyes very prominent. *Rostrum* longer than the pronotum (6:5), strongly curved, with a smooth median costa and two carinae on each side of it,

the intervening sulci rugosely punctate. *Antennæ* with joint 1 of the funicle 1.5 times as long as 2, 3 slightly longer than broad, 4-6 about as long as broad, scarcely widening distally. *Prothorax* transverse (6.5 : 5), rounded at the sides, widest behind the middle, more narrowed in front, with the base subtruncate; the dorsum rather closely punctate, without a median costa, with sparse fine hairs and stouter setæ, all transversely recumbent. *Elytra* more narrowly ovate (5 : 3), slightly rounded at the sides, widest behind the middle, obtusely acuminate behind; the striæ with closely set punctures that diminish behind, and each contain a minute recumbent hair; the intervals slightly convex, each with a median row of rather broad but pointed recumbent setæ, and on each side a row of minute recumbent hairs; the lateral intervals without granules; no subapical impressions. *Legs* as in *E. baikieæ*, but the posterior pairs of femora without the basal inferior fringe of hairs; the front tibiæ more sinuate basally and more dilated apically, with a fine carina on the inner edge.

Length 2.75-3.1 mm., *breadth* 1.1-1.3 mm.

BELGIAN CONGO: Komi, Sankuru, 2 ♂♂, bred from larvæ in flower-buds of *Baikiea*, xi. 1930 (*J. Ghesquière*).

Endæus carinifrons, sp. n.

♂♀. Dark brown, thinly clothed with very short golden hairs and subrecumbent setæ, mottled with irregular darker patches on which the hairs and setæ are brown.

Head shallowly constricted immediately behind the convex eyes, the posterior part with shallow fine punctures and sparse golden hairs; the forehead with denser hairs and a median carina ending in a fovea behind. *Rostrum* almost similar in the two sexes, slightly longer than the pronotum, stout, strongly curved, with a median carina that is continuous with that on the forehead and with two complete carinæ (and sometimes one or two shorter ones) on each side of it, the interspaces rugulose. *Antennæ* with joint 2 of the funicle nearly as long as 1, 3 usually longer than broad (transverse in small specimens), 4-6 transverse and moniliform, widening distally. *Prothorax* transverse (9 : 11), rounded at the sides, widest behind the middle, more narrowed in front, the apex broadly

but shallowly sinuate dorsally, the base more or less bisinuate; the dorsum with large close punctures, without any median line, the fine hairs and short setæ all lying transversely. *Elytra* broadly ovate, very slightly wider behind the middle, with a very shallow transverse dorsal impression at one-fourth from the base and a deep subapical constriction, the posterior calli broad and obtuse; the striæ deep, containing large close punctures; the intervals convex, subcostate (except int. 1), the lateral ones bearing a row of minute indistinct granules; intervals with sparse short recumbent hairs and two irregular rows of short truncate subrecumbent setæ. *Legs*: front femora with a large triangular tooth, and the usual row of erect setæ beyond it, the basal half without a fringe, the posterior pairs with a much smaller tooth; front tibiæ carinate on the inner edge, with a deep sinuation on the basal two-thirds followed by a very obtuse angulation.

Length 2.7-4.8 mm., *breadth* 1.3-2.4 mm.

BELGIAN CONGO: Sankuru, 2 ♂♂, larvæ in seeds of *Pentadesma butyracea*, iv. 1925 (*J. Ghesquière*-type); Befale, 7 ♂♂, 4 ♀♀, xi. 1927 (*J. G.*); Kole, 2 ♂♂, 2 ♀♀, from seeds of *Allanblackia*, 2 ♂♂, from seeds of *Pentadesma*, 11. 1928 (*J. G.*). UGANDA: W. Ankole, 4500-5000 ft., 1 ♀, x. 1911 (*Dr. S. A. Neave*).

The following key will serve to distinguish all the species of *Endæus* hitherto described from continental Africa:—

- | | | |
|---------|---|------------------------------|
| 1 (16). | Elytra without subapical calli or impressions, | |
| 2 (13). | Setæ on elytra recumbent or subrecumbent, | |
| 3 (6). | Anterior tibiæ with the carina on the inner edge prolonged longitudinally near the apex into a small sharp tooth, | |
| 4 (5). | Intervals on the elytra much broader than the striæ, almost flat | <i>floralis</i> Mähli, 1907. |
| 5 (4). | Intervals on elytra as broad as the striæ, convex | <i>rufus</i> Hust., 1929. |
| 6 (3). | Anterior tibiæ without such a tooth on the inner edge, | |
| 7 (12). | Eyes normally convex, not prominent. | |
| 8 (9). | Forehead longitudinally impressed between the eyes, broader than one-third the width of rostrum | <i>castus</i> Boh., 1836. |

- 9 (8). Forehead not impressed, one-third the width of rostrum or less.
- 10 (11). Prothorax with dense fine punctures and scattered larger ones *parilis* Fst., 1898.
- 11 (10). Prothorax with fairly close strong punctures *banhinæ* Mshl., 1907.
- 12 (7). Eyes very convex, almost subconical. *fuscirostris*, sp. n.
- 13 (2). Setae on elytra erect or suberect.
- 14 (15). Eyes not prominent, forehead nearly as broad as base of rostrum; pronotum with dense coarse punctures and no median costa; elytra with long erect setae, no granules on lateral intervals *hispidus* Mshl., 1907.
- 15 (14). Eyes very prominent, forehead half the width of rostrum; pronotum sparsely punctate, with a feeble median costa; elytra with short suberect setae, arising from fine granules on the lateral intervals only *baikiæ*, sp. n.
- 16 (1). Elytra with marked subapical calli followed by a deep impression.
- 17 (18). Head very shallowly constricted behind the eyes; forehead one-third as wide as rostrum, with a strong median carina; prothorax rounded laterally, narrowing at the base *carinifrons*, sp. n.
- 18 (17). Head very deeply constricted behind the eyes; forehead one-fourth as wide as rostrum, without a carina; prothorax parallel-sided in the basal three-fourths *callonæ* Hust., 1924.

Subfamily NANOPHYINÆ.

Nanophyes ealensis, sp. n.

♂♀. Derm testaceous-yellow to testaceous-brown; pronotum with a very indefinite and variable dark patch on each side, sometimes covering a large area, sometimes reduced to a small spot. Colour of elytra very variable; in its most reduced condition there is a row of small dark spots on interval 1, starting at some distance from the base and not reaching the apex, on int. 3 an elongate spot close to the base and three or four smaller ones behind it, and similar rows of small spots on the posterior two-thirds of ints. 5 and 7; but more often the discal spots are more or less confluent, forming a large indefinite subtriangular dark patch. Underside pale yellow.

Head with fine recumbent yellowish hairs, the forehead at its narrowest as wide as the middle of the scape.

Rostrum of ♂ longer than the pronotum (9 : 8), the part beyond the antennæ half as long as the scape, quite straight from the base to the antennæ, then very slightly bent ; the dorsum with very shallow subconfluent punctures and recumbent yellow setæ, indistinctly carinate in the middle and on the lateral margins ; rostrum of ♀ as long as the head and pronotum, the apical part about as long as the scape, very slightly curved ; the dorsum more finely punctate and almost bare, with a low median carina near the base and a shallow sulcus on each side of it, the lateral carina more distinct, and the area below it subsulcate. *Antennæ* testaceous, with the club darker ; length of scape 0.62, funicle 0.50, club 0.55 mm. ; joints 4 and 5 of the funicle transverse ; the two basal joints of the club distinctly transverse. *Prothorax* slightly longer than half the basal width, feebly sinuate at the sides ; the dorsum gently convex longitudinally, feebly aciculate, with rather dense yellowish setæ and a few white ones. *Elytra* with the shoulders rather prominent, somewhat rapidly narrowing behind, and with the sides almost straight ; the striæ rather deep, but the punctures almost obsolete ; the intervals gently convex, with the setæ denser than usual (6 or 7 across the middle of int. 3), int. 8 with a row of 20-24 minute black granules on the basal third (reduced to 4 or 5 on the only ♂ specimen) ; the setæ black on the dark areas (and sometimes on the light parts also), yellowish elsewhere, with a few white patches, especially on ints. 1 and 3, the white setæ appearing broader than the others. *Legs* pale testaceous, usually with a large subapical dark patch on the femora, which bear one long and two short teeth.

Length 2.9-3.2, breadth 1.8-2.0 mm.

BELGIAN CONGO : Lolifa, Eala, 1 ♂, 4 ♀♀, bred from seeds of " Witi " (Ebenaceæ), ix. 1930 (*P. Staner*).

This comparatively large species much resembles in shape the figure of *N. pardus* Mshl. (Trans. Ent. Soc. Lond. lxxv. 1927, pl. x. fig. 6), which species also has a colour-pattern very similar to that of the palest specimens of *N. ealensis* ; *N. pardus* differs, however, *inter alia*, in having no granules on interval 8 of the elytra, and has only two teeth on the femora.

Subfamily *ITHYPORINÆ*.*Palæocorynus entadæ*, sp. n.

♂♀. Piceous, with dense brown scaling above; prothorax with a very indefinite darker patch on each side of the median line at the base; scutellum whitish; elytra with a large transverse, oval or subtriangular, common yellowish patch at the top of the declivity, narrowing outwardly on each side to stria 3, gently arcuate or almost straight on its anterior margin and angulate posteriorly; in front of this patch a very indefinite transverse blackish marking, and the lateral area on each side of the patch mottled with greyish scales; underside with subcontiguous greyish scales.

Head rather coarsely punctate, but the sculpture almost entirely concealed by scaling; the forehead rather deeply impressed transversely. *Rostrum* short, of about the same length in the two sexes, as long as the pronotum, strongly narrowed from the base to the antennæ, thence parallel-sided to the apex, rugosely punctate and indistinctly tricarinate in the basal half. *Antennæ* of ♂ inserted slightly in front of the middle, of ♀ slightly behind it; funicle with the two basal joints equal, 3 longer than broad, the remainder as long as broad (♀), or slightly transverse and moniliform (♂); club comparatively short, broadly ovate, shorter than the four preceding joints. *Prothorax* slightly broader than long, rounded at the sides, slightly widening from the base to the middle, much narrower at the apex than at the base (4.5 : 7), but without any subapical constriction, the basal and apical margins gently arcuate; the dorsum strongly convex longitudinally, highest at the middle, closely set with deep punctures, each of which is completely covered by a large rounded scale, with a sharp median carina (partly covered by scales) that reaches the apex, but not the base, and with scattered suberect spatulate squamiform setæ. *Scutellum* rounded. *Elytra* comparatively short and broad, the length less than twice the width (16 : 10) and more than twice the length of the pronotum (16 : 7), the posterior calli inconspicuous; the striae rather narrow, with deep spaced punctures, each containing a narrow recumbent scale; the intervals

broad, convex, int. 3 elevated throughout and higher than any of the others, 5 also slightly raised throughout, 4 elevated for a short distance only near the base, 2 obtusely raised and slightly dilated for a short distance behind the middle, 1 flat throughout; the intervals with a row of small shiny granules (more numerous on 3 and 5), each bearing a suberect spatulate seta. *Legs* with dense brown scaling and suberect scale-like setae; femora on the outer face grey at the base and along the dorsal margin on the basal half, with a dorsal grey spot beyond the club and a ventral one before the tooth, the shaft of the hind pair not very broad, gradually widening distally, and without a lateral carina, the tooth bearing two or three denticles; tibiae darker near the base and with a pale median patch, strongly bisinuate on the inner edge, and the hind pair sinuate dorsally on the apical half. *Sternum* with the prosternal carinae higher behind than in front, sinuate, and not produced into a sharp angle behind; the intercoxal process of the mesosternum simple. *Venter* with the pygidium visible from below in ♂.

Length 5.6-6.0 mm., *breadth* 2.5-2.8 mm.

BELGIAN CONGO: Haut Lopori, 2 ♂♂, 3 ♀♀, bred from seeds of *Entada*, x. 1927 (*J. Ghesquière*).

The smallest species of the genus described as yet. Apparently closely related to *P. brevipennis* Hust., 1924, but, judging by the description, the latter species lacks the conspicuous pale patch on the elytra, the forehead is scarcely impressed, and no mention is made of the denticulations on the tooth of the hind femora or of the dorsal sinuation of the hind tibiae.

Palaeocorynus sellatus, sp. n.

♀. Black, with dense, light brown scaling; head and pronotum uniform brown; scutellum yellowish; elytra with an indefinite blackish patch at the base of intervals 3-5, a very large common subquadrate black patch from one-fifth from the base to beyond the middle and extending laterally to interval 5, immediately followed by a common triangular yellowish patch with its apex directed backwards and its base extending laterally to stria 2, and this again followed immediately by an elongate black patch confined

to interval 1; underside with light brown scaling scarcely paler than that of the upper side.

Head rugosely punctate, the intervals showing through the scaling here and there as granules or short ridges; the forehead flat, with an elongate median fovea. *Rostrum* longer than the pronotum (5:4), subcylindrical, strongly curved, rugose and 5-carinate in the basal third. *Antennæ* inserted well behind the middle; funicle with joint 2 distinctly longer than 1, the remainder all longer than broad; club obovate, widest beyond the middle, as long as the three preceding joints. *Prothorax* as long as broad, rounded laterally, widest at about the middle, narrower at the apex than at the base (5:7), without any subapical constriction, both base and apex arcuate; the dorsum moderately convex, highest at the middle, closely set with deep punctures, each of which is completely covered by a large rounded scale, with a sharp median carina from the apex to one-third from the base, and with scattered suberect clavate dark setæ. *Scutellum* rounded. *Elytra* comparatively short and broad, the length less than twice the width (18:11) and more than twice the length of the pronotum (18:8), the posterior calli inconspicuous; the striæ broad and deep, with large spaced punctures containing a narrow scale (not obvious on the black areas); the elevation of the intervals similar to that in *P. entadæ*, but more pronounced, and the granules larger. *Legs* with uniform brown scaling except for an indefinite blackish patch on the basal half of the tibiæ; femora with the shaft narrow, parallel-sided, with a bare lateral carina, the tooth of the hind pair not denticulate; the anterior pairs of tibiæ almost straight and very feebly bisinuate on the inner edge, the hind pair deeply sinuate internally on the basal half, and more shallowly sinuate dorsally on the apical half. *Sternum* with the prosternal carinae low, covered with scales, sinuate and not produced into an angle behind; the mesosternal process simple.

Length 7.5 mm., breadth 3.0 mm.

BELGIAN CONGO: Lodja, Sankuru, 1 ♀, eating leaves of coffee, ii. 1930 (*J. Ghesquière*).

Distinguished from *P. brevipennis* Hust., *inter alia*, by its striking colour-pattern and carinate femora.

Subfamily *CRYPTORRHYNCHINÆ*.Genus *EUCRAS*, gen. nov.

Head visible from above when retracted, the forehead as wide as the broadest part of the rostrum near its base; eyes widely separated beneath. *Rostrum* very similar in the two sexes, deeply constricted at the base, thence parallel-sided to the apex, broader than deep. *Antennæ* inserted beyond the middle of the rostrum in both sexes; the funicle a little longer than the scape, hardly dilated distally; the club ovate, rather elongate, segmented. *Scutellum* distinct. *Elytra* much wider at the sub-rectangular shoulders than the prothorax; stria 10 complete and of equal width throughout. *Wings* functional. *Legs*: femora rather broad at the base, moderately clavate, not sulcate beneath, with a single small tooth; tibiæ feebly bisinuate internally, not carinate, with a small apical mucro, the base of the uncus produced externally into a sharp right angle. *Sternum* with the sternal furrow terminating on the mesosternum, there forming a deep horseshoe-shaped cavity which is broadly covered over behind; metepisterna very narrow near the base (there only half as wide as the marginal interval on the elytra), gradually widening behind, with a very strong basal hook. *Venter* with the three intermediate ventrites equal, the first suture deep and straight.

Genotype: *Eucras macrolobii*, sp. n.

The nearest allies of this genus appear to be the Oriental *Zeugenia* Pasc. and typical *Cryptorrhynchus* Ill. (genotype *lapathi* L.). These two genera, however, differ, *inter alia*, in having the following characters:—Forehead narrower than the base of the rostrum; stria 10 on the elytra broad and deep on the basal third, much narrower and obsolescent behind; femora sulcate beneath; tibiæ carinate, not bisinuate internally, with the base of the uncus not angulate; metepisterna nearly twice as wide as the external interval on the elytra, parallel-sided.

Eucras macrolobii, sp. n.

♂♀. Derm black to piceous, hidden by dense light brown soiling above and below; prothorax variable in colour, sometimes uniform brown, or with an indefinite

paler lateral stripe, or two vague darker admedian patches at the base, and usually with a blackish stripe on the basal half of the pleuræ; elytra with a transverse dark band along the base extending to stria 4 on each side of the pale scutellum, a transverse common pale band at the top of the declivity, which is almost straight behind and angulate in front, extending laterally to interval 3, behind the middle a large indefinite irregular subtriangular grey patch with its base on the margin, and its apex almost reaching the sutural pale band, the latter with a dark patch immediately before and behind it, and the rest of the surface mottled with dark and pale markings (sometimes almost uniform dark brown); underside uniform light or ochreous brown.

Head with the sculpture entirely hidden by scaling; no frontal fovea. *Rostrum* with three well-marked carinæ extending nearly to the apex (♂) or to three-fourths (♀), the interstices rugosely punctate, the apical punctation only slightly less strong in ♀ than in ♂. *Antennæ* with joint 2 of the funicle about as long as 1, 3-6 as long as broad and subequal, 7 a little longer. *Prothorax* about as long as broad, almost parallel-sided from the base to the middle, then roundly narrowed to the apex, with a shallow subapical constriction; the apical margin strongly arcuate dorsally, the post-ocular lobes moderately prominent, the base gently arcuate; the dorsum almost flat longitudinally, with close deep reticulate punctures which are longitudinally confluent in front, but all hidden by the large scales, and with scattered recumbent spatulate setæ. *Scutellum* shortly ovate, densely squamose. *Elytra* more than twice as long as the pronotum (7:3), broad (7:5), parallel-sided from the shoulders to the middle, broadly rounded behind, with a strong subapical constriction and obtuse posterior calli; the dorsum gently convex longitudinally, rather steeply declivous behind; the striæ deep, and appearing narrow, the punctures concealed, only indicated by a small narrow pale scale; the intervals rather convex, broad, with a row of short subrecumbent spatulate setæ arising from small shiny granules, which are more numerous and more conspicuous on ints. 3, 5, 7, and almost absent from 4, 6, 8, ints. 3 and 5 very slightly higher than the others. *Legs* short, with dense pale

brown scaling, the femora with an indefinite darker dorsal patch, the tibiae with a well-marked dark patch at one-third from the base.

Length 5.0-6.0 mm., *breadth* 2.4-2.9 mm.

BELGIAN CONGO : Befale, 26 ♂♂, 36 ♀♀, bred from seeds of *Macrolobium dewevrei*, xi. 1927 (*J. Ghesquière*).

Subfamily *BARIDINÆ*.

Trigonobaris lianae, sp. n.

♂♀. Colour dull black throughout.

Head with rather large, very shallow punctures, separated from the rostrum by a deep impression. *Rostrum* of ♂ as long as the middle line of the pronotum, strongly curved dorsally, almost straight beneath, coarsely and closely punctate throughout, the punctures longitudinally confluent on the apical half; rostrum of ♀ much more slender, less convex dorsally, the apical half with fine sparse punctures, but remaining opaque. *Prothorax* about as long as broad, subconical, strongly constricted near the apex, the constriction continued shallowly across the disk, deeply bisinuate at the base, and with large deep reticulate punctures throughout. *Scutellum* with a shallow median impression which is sometimes absent. *Elytra* deeply striate, the striae becoming wider and deeper at the base, the included punctures not incising the margins of the intervals, striae 5 and 6 closely approximated (sometimes united) at the base; the intervals each with a single row of large shallow punctures occupying more than half the width of the interval, closely approximated (except on int. 2), and never rasp-like. *Legs* with coarse reticulate punctures, containing short recumbent white setae; the tibiae not striolate; joint 4 of the tarsi much exceeding 3. *Sternum* with a distinct prosternal furrow, prosternum not bifoveate; metepisterna with a single row of punctures in the middle.

Length 3.0-3.2 mm., *breadth* 1.5-1.6 mm.

BELGIAN CONGO : between Bakatola and Bikoro, 4 ♂♂, 3 ♀♀, bred from galls on stalks of a liana (Loguminosae), ix. 1930 (*P. Staner*).

Much more coarsely punctate than any of the previously described species, except perhaps *T. nanus* Hust., 1928,

which is described as being much smaller (2 mm.), of a shiny blue-black colour, and has the intervals on the elytra incised by the punctures in the striæ, and all the punctures on the intervals rasp-like.

Subfamily CONSONINÆ.

Himatinum coffeæ, sp. n.

♂♀. Red-brown, with stout curved pale setæ.

Head separated from the rostrum by a deep dorsal incision, finely aciculate, with fine short recumbent pale setæ. *Rostrum* somewhat shorter than the prothorax (5 : 6), almost straight, parallel-sided to the apex, in lateral view narrowing from base to apex (less so in ♀), finely but rugosely punctate throughout in ♂ and with suberect curved setæ; the punctures much finer and not rugose in ♀, and the setæ sparser. *Prothorax* sub-cylindrical, narrowly constricted at the base, and from there almost parallel-sided to the subapical constriction, which is continued shallowly across the dorsum, rugosely punctate throughout (including the pleuræ), and set with stout curved subrecumbent setæ, with a faint rounded impression on each side at the middle. *Elytra* wider than the prothorax (4 : 3), parallel-sided from the subrectangular shoulders to three-fourths, jointly and obtusely rounded at the apex, with a shallow subapical impression on each side, and with broad striæ containing large subquadrate punctures; the intervals narrower than the striæ and not broader or higher than the septa between the punctures, each bearing a sparse row of very short fine recumbent setæ, and also a row of suberect stout curved setæ, but the latter are absent from the basal half of intervals 2, 4, 6.

Length 2.25-2.6 mm., *breadth* 0.7-0.8 mm.

BELGIAN CONGO: Sankuru, 4 ♂♂, 2 ♀♀, bred from larvæ in coffee-berries, iv. 1925 (*J. Ghesquière*).

The only other known African species of *Himatinum* is *H. variolosum* Woll., 1873, from South Africa; this is a much stouter insect, having the sides of the prothorax rounded, and with a broad impunctate area on the front margin, and the intervals on the elytra are much broader and higher than the septa between the punctures in the striæ.

Genus *LEUROSTENUS*, gen. nov.

General form elongate, very narrow, and much depressed.

Head constricted behind the eyes, the basal portion globose; the forehead narrower than base of rostrum. *Rostrum* moderately curved, not, or but little, dilated at the apex, shorter and stouter in ♂ than in ♀, the apical edge bearing a fringe of setæ, and not emarginate; the scrobes extending for a short distance on to the lower surface of the head. *Antennæ* inserted at or behind the middle of the rostrum; scape exceeding the front margin of the eye; funicle with seven joints, which are all transverse except the first two, and closely approximated. *Scutellum* conspicuous. *Legs* short; tibiæ with a small mucro in addition to the uncus; tarsi with joint 3 slightly broader than 2, and almost bilobate, 4 almost parallel-sided; the distance between the coxæ about the same in all three pairs.

Genotype: *Leurostenus elæidis*, sp. n.

The species included in this genus are superficially extremely like *Stenotrupis* Woll., 1873, but the latter may be at once distinguished by its 5-jointed funicle.

Leurostenus elæidis, sp. n.

♂♀. Black, moderately shiny, bare, with the antennæ and tarsi ferruginous.

Head rather shallowly constricted immediately behind the eyes, the globular basal part with fine separated punctures above, and transversely striolate beneath, the forehead with larger closer punctures like those on the rostrum; eyes flat. *Rostrum* of ♂ much shorter than the pronotum (6:9.5), comparatively stout, parallel-sided, only slightly curved, with the extreme apex steeply declivous, strongly and closely punctate throughout, with the antennæ inserted at the middle; rostrum of ♀ longer (7:9.5), more slender, narrowing from the base to the middle, and very slightly wider at the apex, strongly curved, the apical margin less declivous, the punctures almost as dense throughout, but smaller, the antennæ inserted close to the base, the distance from it being equal to the length of the eye. *Antennæ* with the scape reaching the middle of the eye, gradually widening from base to apex; club compressed, in its narrower aspect

not wider than joint 7 of the funicle, the two basal joints equal. *Prothorax* much longer than broad (9 : 5), widest near the base, gradually narrowing anteriorly, with the sides slightly curved, abruptly constricted at the base, with the basal angles acutely projecting laterally, deeply constricted near the apex, with the constriction continued across the dorsum, the basal margin truncate; the dorsum quite flat, with close oval punctures, which become smaller and denser at the sides, and longitudinally confluent on the pleuræ; a narrow impunctate median line, and a large impunctate patch on the apical area in front of the constriction. *Scutellum* subtrapezoidal, with the posterior margin rounded, impunctate. *Elytra* much flattened, as wide as the widest part of the prothorax, parallel-sided from the base to two-thirds, shortly produced, and broadly and separately rounded at the apex, distinctly striate, the contained punctures closely placed and slightly broader than the striæ, diminishing behind; the intervals each with a single row of fine spaced punctures, which become denser apically and more numerous on interval 3; the usual impression at the apex of intervals 3-8 is present, and on the actual declivity there is a large deep excavation (more marked in ♂), bounded laterally by a dilatation of interval 3.

Length 2.4-4.5 mm., *breadth* 0.7-0.9 mm.

BELGIAN CONGO: Lodja, 2 ♂♂, found in dried petioles of oil palm (*Elæis guineensis*), vi. 1930 (*J. Ghesquière*—type); Komi, Sankuru, 4 ♂♂, 5 ♀♀, on same plant, ii.-iii. 1930 (*J. G.*); Komi, 1 ♂, 1 ♀, on *Triumfetta*, vii. 1929 (*J. G.*). SIERRA LEONE: Falaba, 1 ♂, ii. 1925, Sembehun, 1 ♀, vi. 1925, Kent, 1 ♀, ii. 1928 (*E. Hargreaves*).

Leurostenus filum, sp. n.

♂♀. Red-brown, opaque, the head and prothorax sometimes blackish; the elytra with a few short recumbent pale hairs towards the apex.

Head with a well-marked constriction, the distance of which from the eyes is greater than the length of an eye, the constriction becoming obsolete in the middle dorsally; the basal part of the head almost impunctate, the anterior part with numerous small punctures that are separated by about their own diameters. *Rostrum* of ♂ much

shorter than the pronotum (2:3), slightly curved, narrowing from the base to the antennæ (which are inserted well behind the middle), and there slightly angulated, then gradually widening to the apex, very finely and closely punctate throughout; rostrum of ♀ nearly as long as the pronotum (4:5), narrower, distinctly curved, with the punctures finer and more sparse. *Antennæ* with the scape reaching the hind margin of the eye, gradually clavate; club somewhat compressed, but wider than joint 7 of the funicle, its basal joint longer than the second. *Prothorax* longer than broad (4:3), broadest not far from the base, gradually narrowing in front, with the sides gently curved, narrowly constricted at the base, with the basal angles projecting laterally, the subapical constriction narrow, and continued shallowly across the dorsum, the base truncate; the dorsum quite flat, with small separated rounded punctures (usually leaving an abbreviated smooth median line) which become denser laterally, but are almost obsolete on the pleuræ; the narrow apical collar impunctate dorsally. *Scutellum* transversely elliptical, impunctate. *Elytra* much flattened, not wider than the prothorax, parallel-sided in the basal two-thirds, without any apical or subapical impressions, finely striate, with the contained punctures a little wider than the striae, and scarcely diminishing behind; the intervals finely aciculate, but without rows of punctures.

Length 2.1–2.4 mm., breadth 0.4–0.5 mm.

BELGIAN CONGO: Lodja, 1 ♂, 4 ♀♀, in dried petioles of *Elais guineensis*, iv. 1930 (*J. Ghesquière*).

II.—On the *Cynodont Reptile* *Thrinaxodon liorhinus* Seeley. By F. R. PARRINGTON, M.A., Assistant Superintendent of the University Museum of Zoology, Cambridge.

INTRODUCTION.

Thrinaxodon liorhinus is probably the best-known *Cynodont*. It was first described by Seeley in 1894 (1) from a specimen thought by Owen to be the same as his *Galesaurus planiceps*. The original material was further

described by Watson in 1920 (2), and several specimens have been described by Broom (3) and Haughton (4) under the synonym *Ictidopsis elegans*.

In the course of the last twelve months I have received from Mr. A. W. Putterill of Harrismith, O.F.S., three specimens collected from the *Lystrosaurus*-zone. This material adds a number of details to those already known, and brings up for discussion problems which are of importance in their bearing on the Theriodonts in general.

DESCRIPTION.

The first specimen consists of the skull and lower jaw, left arm and hand, and fragments of ribs and vertebrae of an animal which became largely disarticulated during the process of burial. The size of the arm-bones, which are considerably smaller than those described by Haughton, indicates that the specimen is that of a very young animal. It is preserved in a very hard matrix, which has allowed only certain parts to be prepared.

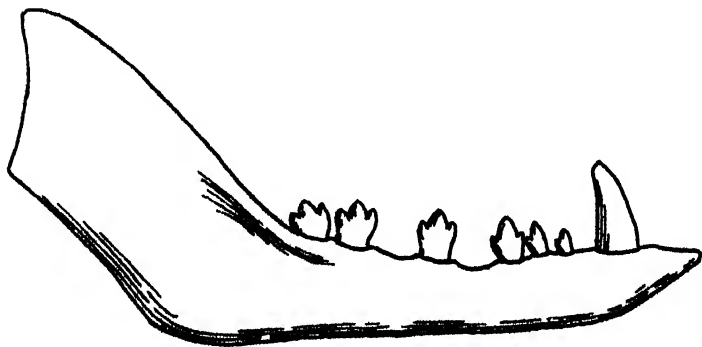
The left maxilla and dentary are in natural relation. The upper canine is in place and also the second, third, and fifth molars, the fifth having larger subsidiary cusps than the other two. The right maxilla has been separated and cleaned from the palatal side. The canine has been lost, but a replacing tooth is visible between its socket and the palatal pit into which the lower canine fits. Only part of one upper molar remains in this side, but the sockets show that the six molars occupied 16 mm. as in the left maxilla.

The right dentary has been exposed (fig. 1, p. 18). The incisors are missing, but the canine is in place and was followed by eight molars. Two of these, the fourth and sixth, were lying free and have been separated from the matrix. The first is very small (2 mm.) and has a main cusp which is followed by a small posterior one. The second is larger, but also lacks the anterior cusp. The third is of the usual type, and, from this tooth backwards, the anterior and posterior cusps increase in size until in the last two teeth they closely resemble those of triconodont mammals in outward view. The fourth and sixth molars had the cusps damaged while they were being extracted. There is no trace of a cingulum, and the three cusps are nearly in a straight line. The main cusp

curves slightly inwards. The roots, which are long and oval in section, show a slight depression down the centre of the inside, suggesting a forecast of the division of the root. In the left dentary two incisors are in place, the first having a small replacing tooth pressed against its root.

The fore limb of *Thrinaxodon* has been described by Haughton from two specimens, and the hand has been figured by Broom. The left arm and hand are exposed in dorsal view in this specimen. The humerus is 29 mm. long, the radius 26 mm., and the ulna 25 mm. These measurements indicate a young animal. This may account for the

Fig. 1.



Thrinaxodon liorhinus Seeley. Right dentary. $\times 2$.

fact that, while the first two rows of carpals agree with previous descriptions, there are five bones in the distal row, the fifth being very small and presumably due to fuse with the fourth.

Haughton gave the digital formula as 2.3.3.—.—, but Broom's figure shows the normal formula of 2.3.4.5.3, with the usual reduction in the size of one phalanx in the third finger and two in the fourth. Here the first finger is not clearly seen, but the second and third agree with Broom's figure. In the fourth, however, there are only four phalanges, the second being reduced. It is not of the usual type, being concave proximally and convex distally and having no waist. There is little

disturbance, and it seems improbable that the second rudimentary phalanx has been lost in burial. Were the specimen that of a large animal the explanation might lie in fusion, but in a young animal it can only be explained as an abnormality. The fifth finger is normal and the formula for the hand thus becomes — . 3 . 4 . 4 . 3.

The second specimen consists of a skull lacking the postorbital and jugal arches and the premaxillæ, but otherwise beautifully preserved.

The occiput shows the tabular surrounding the post-temporal foramen as described by Houghton. A specimen of *Galesaurus planiceps*, in my possession, shows a similar condition and by comparison with the type-specimen suggests an explanation of the discrepancies in the descriptions of this bone. It consists of a plate of bone lying pressed against the squamosal on its outer edge, which becomes quite thin below the post-temporal opening. This thin portion may be broken off, leaving a slight ridge which may easily be mistaken for a suture.

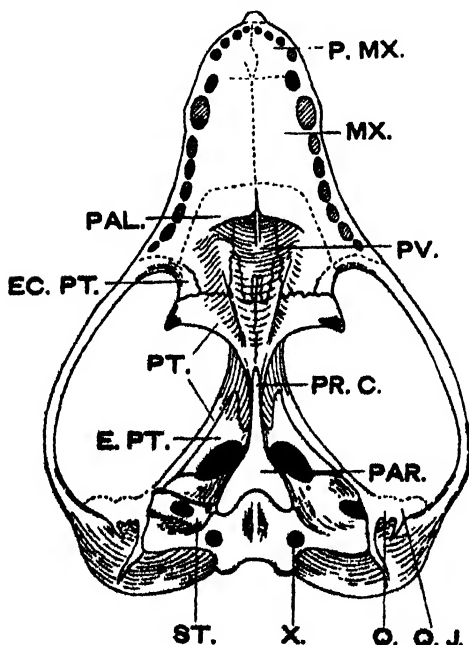
The palate agrees with Watson's figure except in two points. The quadrate rami of the pterygoids retain the primitive connection with the quadrates, supporting the epipterygoids underneath. The parasphenoid is a thin Y-shaped plate of bone which lies below the basisphenoid and runs up between the vertical plates of the pterygoids, where they meet to form the pterygoid bar. Hidden in this region it reappears where the pterygoids begin to separate, and reaches to within 9 mm. of the fused prevomers. This anterior processus cultriformis was observed by Houghton (fig. 2, p. 20).

There are two small foramina for the twelfth nerve on the inside of the pit of the foramen jugulare.

In the left side traces of two incisors are present followed by parts of the third and fourth. The canine is followed by six molars, all apparently with three cusps, the third and fourth being the largest teeth, and the fifth and sixth the smallest. There is a slight gap between the third and fourth. In the left maxilla seven molars are present, and the appearance suggests that it is the fourth tooth which is the additional one because it is slightly smaller than the third or fifth. There are three incisors in the left dentary, the formula for the lower jaw thus becoming I. 3 . C. 1 . M. 8.

The third specimen is the skull of an animal of about the same size as the second. The snout and occiput have been damaged and the postorbital and jugal arches are missing. Crushing has broadened the snout and produced numerous fractures.

Fig. 2.



Thrinacosodon liorhinus Seeley. Palate, modified after Watson. $\times 1$.

P.MX., premaxilla; MX., maxilla; PV., prevomer; PAL., palatine; EC.PT., ectopterygoid; PT., pterygoid; E.PT., epipterygoid; PAR., parasphenoid; PR.C., processus cultriformis of the parasphenoid; Q., quadrate; Q.J., quadrato-jugal; ST., stapes; X., pit for the foramen jugulare.

The molar teeth of this specimen are the only point of interest. In the right maxilla there are eight. The first, which is small, lacks the anterior cusp, and the last, which is about the same size, appears to be without the posterior cusp. In the left maxilla there are three teeth, followed

by the socket for the fourth and then three more. These seven molars occupy 16 mm., as in the previous specimens, but the eight in the right side occupy 18 mm.

While it is not possible to compare the proportions of this skull with others, owing to the crushing it has undergone, careful examination fails to show differences from the normal form except in the molar teeth.

DISCUSSION.

The questions arise as to whether the third specimen is rightly referred to the species *T. liorhinus*, and as to the meaning of the extra tooth in the second specimen.

Practically all the material of this genus is known to have been collected from the *Lystrosaurus* zone.

It has long been known that *Nyctosaurus larvatus* (Owen) is a very closely related animal, but, owing to the poor quality of the only two known specimens, the distinction rests on the occurrence of eight upper molars in this genus, and some at least of them have four or five cusps. Haughton mentions a lower molar of *Thrinaxodon* in which an additional cusp is visible in the inside view, but Broom states that he has never seen any specimen in which there are more than three cusps. It seems that—for the present, at least—the two genera should be kept apart on this character.

Broom has referred to the species *Galesaurus planiceps* specimens in which there are nine, eleven, and twelve molars, and shows that the specimens with the extra teeth are the largest and that the teeth occupy a greater length, and he suggests that those with the nine molars are young. The type of *Thrinaxodon liorhinus* is one of the largest skulls described, and since it has only six upper molars the extra teeth cannot be accounted for in the same way.

The possibility of teeth of two dentitions being present is ruled out by the increased space occupied in one side of the third specimen but not in the other, though this explanation may cover the extra tooth in the second specimen.

While examining some of my material in 1930, Professor W. K. Gregory commented on the small size of the accessory cusps in the first specimen as compared with the

specimen in the American Museum of Natural History (no. 5630), a point which is evident in all three specimens when they are compared with his drawing (5). Variation seems the most reasonable explanation of this point, and, since the specimen is obviously nearer *T. liorhinus* than Broom's newly described *T. putterilli* (6), it may well cover the discrepancies in the number of teeth in this series. There seems no purpose in making a new species, particularly on poor material.

The well-developed processus cultriformis of the parasphenoid is of interest in the problem of the origin of the mammalian vomer.

Until recently the median "vomer"-like bone of Cynodonts has been accepted as homologous with the vomer of mammals. It was believed to be in contact with the basis cranii posteriorly and to have developed from the parasphenoid. Since the true parasphenoid has been recognised in Theriodonts, however, the "vomer"-like bone of the later members has been accepted as the fused prevomers of the primitive forms.

The history of the parasphenoid has been one of steady reduction from the enormously developed amphibian type, where it may be in contact with the prevomers anteriorly, to a thin Y-shaped plate of bone lying under the basisphenoid in the Cynodontia and Bauriamorpha. Only in a few Cynodonts is there an anterior processus cultriformis to the bone, *T. liorhinus* showing the most primitive condition of such forms in which it has been described. The contemporaneous Bauriamorpha appear to possess at the most the basal plate, while Watson (7) has shown that the Scalopsauridae lack the bone altogether.

The history of the prevomers, in the meantime, has been one of steady increase in size and posterior development. In the early Therocephalian *Scymnosaurus ferox* (Broom) they consist of narrow strips of bone dividing the internal nares, and although they join the pterygoids they do not extend posteriorly to the internal nares, the junction resulting from the primitive anterior position of the pterygoids. In other members of the group they are larger and may be fused. In the Gorgonopsia the prevomers have fused and extend posteriorly to meet the pterygoids nearly as far backwards as the middle of the

skull. Sometimes this junction is hidden by the palatines meeting below them in the middle line.

In the Cynodonts and Bauriamorphs there is a still greater posterior development and the bone now consists of a plate which overlies the palatines and pterygoids on the ventral side and which may extend downwards to support the false palato.

A continuation of these evolutionary trends would result in the fused prevomers extending backwards to the anterior part of the basis cranii in the manner of the mammalian vomer, and in the parasphenoid being lost. Thus the original homology of the mammalian vomer with the so-called prevomers of reptiles is a reasonable conclusion, and the loss at the parasphenoid in mammals can be explained.

If, on the other hand, the mammalian vomer developed from the parasphenoid, then both these evolutionary trends must have been reversed, though they proceeded steadily from the Carboniferous period at least to the middle of the Trias. The dwindling parasphenoid must have re-developed anteriorly and finally replaced the enlarged prevomers. Such a profound change is difficult to imagine and unnecessary to account for the structure of the mammalian skull. It cannot be accounted for by the development of brain-case alone. Growth in this region might result in the parasphenoid extending further anteriorly, but could never cause it to lie along the snout as does the true vomer.

If the parasphenoid-vomer homology is true, however, it suggests that the origin of mammals must be looked for among members of the Theriodonts in which a processus cultriformis has been retained, and in this respect the Bauriamorphs are quite unsuitable.

In the consideration of this problem much weight has been placed on the structure and development of the "dumb-bell" bone of *Ornithorhynchus*. It has been generally accepted that the anterior "dumb-bell" bone shows evidence of a separate origin and represents the prevomers, a conclusion which leaves only the parasphenoid to account for the vomer.

An embryo has been described by Green (8), however, in which the palatine processes of the premaxillæ are

joined to the "dumb-bell" bone by a thread-like ossification, which is later absorbed, an observation which throws doubt on the prevomerine nature of the bone and on the accepted interpretation of this region of the skull.

In conclusion, I wish to thank Dr. W. D. Lang and Dr. W. E. Swinton for facilities for examining material in their charge in the British Museum, and Professor D. M. S. Watson for his great help and kindness in allowing me to see specimens in his possession and in discussing my results.

REFERENCES.

- (1) SEELEY, H. G. 1894. Phil. Trans. Roy. Soc. B, vol. clxxxv.
- (2) WATSON, D. M. S. 1920. "On the Cynodontia." Ann. & Mag. Nat. Hist. (9) vol. vi.
- (3) BROOM, R. 1912. "On some new Fossil Reptiles from the Permian and Triassic Beds of South Africa." Proc. Zool. Soc. pp. 859-876.
- (4) HAUGHTON, S. H. 1924. "On Cynodontia from the Middle Beds of Harriamith, Orange Free State." Ann. Trans. Mus. xi. 1924, pp. 74-92.
- (5) GREGORY, W. K. 1920. "Studies in Comparative Myology and Osteology." Bull. Amer. Mus. Nat. Hist. vol. xlii. p. 133.
- (6) BROOM, R. 1932. 'The Mammal-like Reptiles of South Africa' (London: H. F. & G. Witherby), p. 273.
- (7) WATSON, D. M. S. 1931. "On the Skeleton of a Bauriamorph Reptile." Proc. Zool. Soc. 1931, pt. 3, pp. 1163-1205.
- (8) GREEN, H. L. (1930.) "A Description of the Egg-tooth of *Ornithorhynchus*, together with some Notes on the Development of the Palatine Processes of the Premaxilla." 'Journal of Anatomy,' vol. xlii. pt. 4.

III.—*New African Species of the Dipterous Genus Paralimna (Ephydriæ).* By EZRA T. CRESSON, Jr., The Academy of Natural Sciences of Philadelphia.

THROUGH the interest of Dr. F. W. Edwards, of the British Museum, and the liberality of Sir Guy A. K. Marshall, Director of the Imperial Institute of Entomology, I had the privilege of studying an interesting series of Ephydriæ from Africa, collected mostly in equatorial localities such as Sierra Leone, Gold Coast, Nigeria, and Kenya. This material was exceptionally rich in species of the genus *Paralimna*, eleven being recognized, of which nine are here described as new. The other

two are *nubifer* Cresson, represented by sixty specimens from Sierra Leone, Gold Coast, and Nigeria; and one female, from Nairobi, Kenya, of *nigripes* Adams. The series studied of this genus contains 103 specimens, not including several in too poor condition for critical study.

Africa is apparently rich in species of *Paralimna*, and will no doubt easily rival Neotropical America in this respect. In addition to the eleven above-mentioned species, five others are known to me as occurring within the African fauna, not including the Palearctic forms in the north. There are two others described under this genus which I have not been able to recognize in any material studied, and one of these, *fulvipes* Bezzi, from the Congo, probably does not belong here.

Paralimna vansomereni, sp. n.

Very similar to *P. confluens* Loew, but the maculation of the wings is limited to large clouds over the cross-veins and (in the two specimens before me) over an appendage from the fourth vein in the first posterior cell midway between the cross-veins. Proximally and distally and between these clouds there are noticeable whitish areas, which, however, do not surround the clouds. There is also some trace of clouding along the fifth vein; the bases of the tarsi are black. In the frontal marking and otherwise there is apparently no difference of specific importance. Length 3 mm.

Unfortunately, my series of *confluens* and the present species are small and not in first-class condition.

Type.—Male; Nairobi, Kenya (*Van Someren*; vii. 1930) [British Museum Collection].

Paratype.—Female; topotypical.

Paralimna comata, sp. n.

The rectangular profile of the head with its straight right angular facial and oral contour, the fine hair-like facial bristles and the number of arisal hairs are the outstanding characters of this species.

Head higher than long, as broad as high; in profile rectangular with the frons horizontal. Eyes round. Frons distinctly broader than long, with parallel orbits; predominant colour ochreous with cocoa-brown markings

becoming blackish anteriorly in certain aspects; anterior proclinate orbitals aligned with the reclinate frontals; antennal orbital spots indistinct. Face somewhat longer than broad, straight and vertical in profile with oral margin horizontal and straight, cinereous, becoming ochreous above; carinal hump very weak; facialia about three times as broad as the parafacies, very finely setulose with hair-like bristles, the upper two of which are much weaker than the proclinate front-orbitals. (The uppermost facial bristle is stronger when the usual next lower is absent.) Cheeks one-fourth as high as head, cinereous, with one bristle as long as the ocellars; postbucca infuscated. Tormæ retracted. Proboscis and palpi black. Antennæ situated distinctly above centre line of eyes; the interantennal distance about equal to the diameter of the second antennal segment; the latter black; third twice as long as broad, rather pale yellowish to whitish in some aspects, with whitish pile; arista slightly overreaching third segment, with eleven to twelve black hairs.

Mesonotum ochreous with cocoa-brown markings and irrorations; the former somewhat coalescing into longitudinal stripes, especially anteriorly. Humeri, pleura, and metanotum cinereous with a brown stain on the mesopleura. Scutellum brownish basally, greyish marginally and shining black apically; flat, broad as long, setulose. Halteres yellow. Squamæ whitish with concolorous cilia. Femora and tibiæ (except apices of latter) black, sparingly cinereous. Fore femora of male with long, somewhat flattened, and apically curved bristles in the distal half of the postflexor series; their tibiæ slightly bowed; all tarsi tawny, somewhat darkened apically. Wings immaculate, evenly stained with brown; second costal section 2.5 to 3 times as long as third; second section of fourth vein slightly longer than its third.

Abdomen with the brown bases of segments 3 and 4 broader than the medianly interrupted cinereous apical bands, which latter are somewhat dilated medianly. Length 4 mm.

Type.—Male; Ibadan, S.P., Nigeria (*F. D. Golding*; vii.-xi. 1925; swept from cotton) [British Museum].

Paratypes.—3 ♀; topotypical.

Paralimna distenta, sp. n.

A species not markedly different from *comata* except in its larger size (5 to 5.5 mm.), in its more developed facial hump, and stronger facial bristles. The brown pattern of the mesonotum is more intensively developed, coalescing into broad contrasting vittæ, thus reducing the number of the irrorations. The ochreous tinge of the otherwise cinereous areas is also noticeable.

Head as long as high, rectangular in profile, with a noticeable hump in the upper part of the facial profile; oral margin slightly sinuous. Predominant colour of frons ochreous with cocoa-brown markings; of the face, plumbeous with a yellowish tinge, becoming brownish above; the interantennal area opaque black or dark brown. Second antennal segment intense black or dark brown, contrasting with the yellowish third; arista with 13 to 15 hairs. Upper facial bristle almost as long as the proclinate frontorbital, but not as stout; buccal bristle as long and as stout as the ocellars. Mesonotum ochraceous, with broad brown vittæ, with a few irrorations between. Mesopleura with distinct brown stain medianly.

Fore femora of the male with flexor groove and with flattened, strongly apically-curved bristles in the distal half of the anterior flexor series; their tibiæ noticeably bowed, entirely, or the greater part distally, tawny; of female only apices tawny; their tarsi (except apices) tawny. Of middle and hind legs, only apices of tibiæ and bases of tarsi pale. Wings immaculate with brown tone.

The brown abdominal bands opaque, or shining if abraded, with the apically median extension well marked on third to fifth segments.

Type.—Male; Ideam, near Bude Egba, Northern Nigeria (*Dr. J. W. Scott Macfie*, 27. v. 1912) [British Museum].

Paratypes.—1 ♀, Kotoba Camp, Southern Nigeria (10. xi. 1913). 1 ♀, Egbe, Northern Nigeria (28. viii. 1912). 2 ♀, Offa, Northern Nigeria (25. iii. 1912). 3 ♀, Osi, Northern Nigeria (28. viii. 1912). 1 ♀, Gogo, Northern Nigeria (26. viii. 1912). 2 ♀, Bude Egba, Northern Nigeria (28. v. 1912). 1 ♀, Oshogbo, Northern Nigeria. All collected by Dr. J. W. Scott Macfie.

Paralimna egena, sp. n.

Another species very similar to *comata* and *distenta* just described; differing from the former in the stronger facial bristles; from the latter in its smaller size, in the general grey colour rather than ochreous, and the browns more subdued and tinged with ochreous. On further comparison with *distenta* we find the head and face broader in relation to their length, and the face more greyish. The second antennal segment and interantennal area are noticeably opaque brown; arista with about twelve hairs. Upper facial bristle strong. Postbucca and mesopleura not infuscated; bases of abdominal segments rather shining brown to black, the median extensions not well marked. The fore femora of males showing the usual flattened bristles in the anterior flexor series, their tibiae having the apices and bases narrowly pale; bases of tarsi also pale. Wings not so intensively browned as those of *distenta*.

Type.—Male; Ibadan, Southern Nigeria (*F. D. Golding*; vii.-xi. 1925; swept from cotton) [British Museum].

Paratypes.—1 ♀, Zungeru, Northern Nigeria (*J. W. Scott Macfie*, 15. xi. 1910). 1 ♀, Agage, Southern Nigeria (*W. A. Lamborn*, 21. viii. 1913).

Paralimna adversa, sp. n.

This differs from all other African species by having the anterior frontorbital bristle distinctly in advance of the line of the reclinate frontal. In addition, the frons is proportionately narrower than is usual with the other known species; from slightly broader than long to as long as broad. The above are apparently the most distinguishing characters, but we find the face dull plumbeous with a brown median line on the hump and an oblique brown spot on the lower lateral area. The one facial bristle is rather stout, about as strong as the ocellars and slightly above the line of the buccal orbits; cheeks about one-fifth height of head. Antennae situated about on centre line of eyes; the frons, in profile, very convex, not horizontal; arista with about twelve hairs. Pleura cinereous with ochreous tinge, not noticeably brown, although the mesopleura is considerably stained. Fore femora of male with anterior flexor series of flattened

bristles; tarsi pale basally. Wings rather long, immaculate, almost clear. Abdomen marked with grey and brown fasciæ of subequal widths and a distinct median brown stripe; ventral lobes cinereous. Length 3.5 mm.

Type.—Male; Maramu, Sierra Leone (*E. Hargreaves*; 8. x. 1924) [British Museum].

Paratypes.—1 ♀, topotypical. 2 ♂, 3 ♀, Njala, Sierra Leone (*E. Hargreaves*; 1. ix. 1920). 1 ♀, same as latter, 23. iii. 1925, at light.

Paralimna bona, sp. n.

A species similar to *egena*, but with the tarsi entirely black; thus simulating *nigripes* Adams, which species, however, has the pleura brown.

Head broader than high and about as long as high. Eyes slightly oblique. Frons brown, with some ochreous markings, about one-third broader than long; proclinate orbital aligned with the reclinate frontal. Face as broad as long, in profile, vertical with slight hump; plumbeous, becoming brown on hump, which latter colour extends as a median line down to opposite upper facial bristle; the upper two facial bristles as stout as the ocellars, the uppermost slightly above line of buccal orbit; inter-antennal distance about equal to diameter of third antennal segment. Cheeks concolorous with face, about one-fourth height of head; buccal bristle stout, as long as facials; postbucca cinereous. Antennæ situated about on centre line of eyes; second segment black; third twice as long as broad, brownish to greyish, with pale pile; arista with about twelve hairs. Tormæ well exserted, sericeous white. Palpi black.

Mesonotum somewhat brown vittate, otherwise ochreous grey irrorated with brown; lateral sulcus greyish; mesopleura with brown stain and brown spots at base of bristles; remainder of pleura, and metanotum, grey. Scutellum brown medianly, slightly longer than broad, flat.

Legs entirely black, faintly grey on femora; fore femora of male with anterior flexor series of flattened bristles. Wings immaculate, almost clear; second costal section slightly more than twice as long as third; second and third sections of fourth veins subequal.

Abdomen with the brown and grey fasciæ subequal in width, the former dilated medianly forming a median vitta, and the grey fasciæ also slightly dilated medianly indenting the brown. Ventral lobes cinereous. Length 4.2 mm.

Type.—Male; South Masai Reserve, Kenya Colony (T. J. Anderson; 16. v. 1913) [British Museum].

Paratype.—1 ♂, Laikipia Escarpment, Sonje Valley, Solai District, Kenya Colony (T. J. Anderson; 9. ix. 1919).

A male from Weenen, Natal (H. P. Thomasset; ix.-x. 1925) [British Museum], is apparently conspecific with the type, but I cannot consider it paratypic.

Paralimna lynx, sp. n.

A species readily distinguished by the long macrochaetae, especially on the face and cheeks. The face is noticeably elongate, plumbeous, becoming somewhat ochreous above; pleura entirely brown.

Head as broad as long, slightly higher than long. Eyes slightly oblique. Frons much broader than long, blackish to chocolate-brown with ochreous markings and overcasting; orbits somewhat greyish. Proclinate orbitals strong, aligned with reclinate frontals. Face distinctly longer than broad, cinereous to plumbeous, becoming ochreous above, the delimitation not sharply defined; in profile evenly convex, the hump not marked. The two upper facial bristles long and slender, almost cruciate with those opposite, well above line of buccal orbits. Parafacies linear, not much dilated below. Cheek about one-fourth height of head, brown with greyish orbit, the brown sharply limited by the parafacial groove; bristle very long and slender, greatly overreaching the facial profile; tormæ well exerted, concolorous with face. Palpi black. Antennæ well above centre line of eyes; second segment black; third noticeably paler, twice as long as broad, with whitish pile; arista with thirteen hairs.

Mesonotum cocoa-brown with suggestion of ochreous vittæ and irrorated areas, more greyish anteriorly and laterally. Notopleura mostly, and pleura entirely, brown, becoming cinereous on metanotum. Scutellum dark, lighter laterally, flat, as broad as long.

Legs black, sparingly dusted with brown; tarsi of hind legs somewhat tawny basally, of the others black or brown. No anterior flexor series of modified bristles on fore femora of male. Wings strongly tinged with brown; second costal section three times as long as third; second section of fourth but slightly longer than third.

Abdomen mostly brown, semi-opaque, with lateral posterior angles of segments cinereous with ochreous tinge. Ventral lobes of second and third mostly brown. Length 4.2 mm.

Type.—Male; Maramu, Sierra Leone (*E. Hargreaves*; 8. x. 1924) [British Museum].

Paratype.—1 ♀, topotypical. 1 ♂, Njala, Sierra Leone (*E. Hargreaves*; 22. viii. 1928).

The male paratype is much lighter on the thorax and abdomen; the mesonotum is more distinctly vittate and the grey abdominal markings are more extended transversely.

Paralimna nidor, sp. n.

Structurally similar to *nigripes*, but the lighter markings of the head and thorax being strongly tinged with ochre give a darker appearance to this species; those of the abdomen, however, are not so tinged and are noticeably grey in contrast.

Face uniformly dark ochre-brown, scarcely darker on the interantennal hump, nor lighter at the lateral oral angles. The lighter bands of the abdomen are narrower than the dark bases and broadly interrupted medianly. Bases of tarsi somewhat paler.

The proclinate frontorbital is aligned with the reclinate frontal in the specimens before me, but my series of *nigripes* show the frontorbitals well caudad of this line in some specimens, especially the females.

Type.—Female; Nairobi, Kenya Colony (*Van Someren*; vii. 1930) [British Museum].

Paratypes.—3 ♀, topotypical.

A male collected with the above females I have considered to be *nigripes*, although I have not seen specimens of that species so far north. This specimen apparently having all the characteristics of that species may be the male of the present one; in which case we may have here only a colour-variety of *nigripes*.

Paralimna pokuma, sp. n.

A member of the group having the pleura mostly dark. A large robust species with comparatively narrow face. Differing from *nidor* in its larger size, higher head, comparatively narrower face, and in the greater number of arisal hairs.

Head broader than high, higher than long; eyes almost round. Frons much broader than long, in profile convex; chocolate-brown, becoming greyish anteriorly, the labyrinthine markings rather distinct, ochreous. A black antennal-orbital spot sharply defined below from the cinereous parafacies. Reclinate frontal almost as strong as, and far in advance of the line of, the ocellar pair; anterior frontorbital aligned with the frontal. Face distinctly narrower than long, in profile straight and vertical below, distinctly convex above; chocolate-brown, foveæ above, sides of interantennal hump, parafacies, and a fine line mesad of the facial bristles greyish or yellowish; also somewhat grey towards oral margin; a more or less distinct dark line across the hump above; facialia broad above, four times as broad as parafacies, with three to six bristles, of which the upper one is not as stout as the anterior frontorbital. Cheek about one-fourth height of head, concolorous with face but orbit greyish; buccal bristle as long as the ocellars; postbucca concolorous with face. Occiput brown, with orbits greyish. Tormæ black, tinged with brown. Antennæ small, yellowish in certain aspects, with long pale pile; arista with fifteen hairs.

Mesonotum chocolate-brown, with two to four narrow median ochreous stripes and laterally mottled with the same colour, the irrorations more or less coalescing. Humeri greyish; notopleura and pleura mostly brown, the latter becoming cinereous ventrally and posteriorly and on metanotum. Scutellum flat, about as broad as long, brown medianly and basally, leaving the broad margins greyish. Legs black, sparingly brown dusted; bases of tarsi somewhat diluted. Wings immaculate, with brown tinge, second costal section about twice as long as third.

Abdomen with the grey bands much narrower than the opaque brown bases of segments, broadly interrupted medianly, leaving a broad median brown vitta; mesal

portion of ventral lobes of segments 2 and 3 brown. Length 5 mm.

Type.—Female ; Pokuma, Sierra Leone (*E. Hargreaves* ; 2. iii. 1925, on river bank) [British Museum].

Paratype.—1 ♀, topotypical, 11. iii. 1925. It is smaller than the type, 4.2 mm., but is not essentially different in other respects.

IV.—New Lymantriidæ (*Lepidoptera Heterocera*) in the British Museum Collection. By C. L. COLLENETTE.

[Plate I.]

THE insects dealt with in this paper have been derived from various sources, and, with the exception of a paratype of *Porthesia conizona*, are all contained in the British Museum collection. Among those described is a new *Ocneria*, obtained by Major H. St. J. B. Philby in Arabia, and also a striking new *Dasychira*, taken by Mr. W. J. Hughes in Natal. For the donation of several of the specimens the Museum is indebted to the Director of the Imperial Institute of Entomology.

Ridgway's 'Color Standards and Color Nomenclature' (1912) has been employed in the colour-descriptions, and the Comstock-Needham system for the wing-neuration.

Porthesia conizona, sp. n. (Pl. I. fig. 13.)

♂.—Palpus short, porrect, cartridge-buff. Antennal shaft whitish, pectinations buckthorn-brown. Head, together with the bases of tegula and patagium, cartridge-buff ; remainder of thorax Prout's brown. Abdomen above and beneath cartridge-buff (discoloured in the type), anal tuft Prout's brown tipped with ochraceous-tawny. Pectus and legs whitish. Fore wing whitish ; a patch of fuscous irroration reaching from above the anal vein to the inner margin and from the subbasal to the antemedial area ; a broad postmedial fascia composed of fuscous irroration, from costa to inner margin, roughly parallel with the termen, narrower and bent inwards between veins *M*1 and *M*2, somewhat

narrower also between veins *Cu*1 and *Cu*2; fringe whitish. Hind wing, under side of both wings, and fringes whitish.

Expanse, ♂♂, 29–32 mm.

1 ♂ (holotype), Bukoba, W. Victoria Nyanza, 20. viii. 1921 (*N. C. E. Miller*), in British Museum, presented by the Imperial Institute of Entomology.

1 ♂ (paratype), Nsadzi Island, west of Kome Island, N.W. Victoria Nyanza, at light, 24. i. 1914 (*G. D. H. Carpenter*), in Oxford Museum.

Euproctis erythropæcila, sp. n. (Pl. I. fig. 16.)

♂.—Palpus capucine-yellow. Antennal shaft pale yellow-orange, pectinations tawny. Head, thorax, and abdomen orange-buff, the frons capucine-yellow. Legs orange-buff mixed with capucine-yellow. Fore and hind wing, above and beneath, and fringes uniform orange-buff; on the upperside of the fore wing, in the centre of the discocellulars, a round spot of xanthine-orange about .5 mm. in diameter.

♀.—Resembles the ♂, but both body and wings slightly more pale. Anal tuft Saccardo's umber.

Expanse, ♂♂ 39–40 mm., ♀♀ 54 mm.

1 ♂ (holotype), 1 ♀ (allotype), 1 ♂ and 1 ♀ (paratypes), Kampala, Uganda, 18. iv. 1929 (*H. Hargreaves*); presented by the Imperial Institute of Entomology.

Related to *Euproctis crocosticta* Hmps. (1905), but considerably darker and with a smaller discocellular spot.

Euproctis euthypheres, sp. n. (Pl. I. fig. 17.)

♂.—Palpus porrect, apricot-yellow, above and on the outer side fuscous. Antennal shaft cartridge-buff, pectinations ochraceous-buff. Head and thorax apricot-yellow. Abdomen above and beneath cartridge-buff (discoloured in the type). Legs and pectus buff-yellow to cartridge-buff. Fore wing amber-yellow; some fuscous irroration scattered sparsely over the wing; two small fuscous patches, formed by an increase in the irroration, above and beneath the junction of vein *Cu*2 with the cell; a conspicuous fuscous postmedial fascia running in a straight line from the costa just before the apex to a point on the inner margin below the junction

of vein *Cu*1 with the cell ; some fuscous shading extending from the distal side of the postmedial fascia between veins *M*2 to *Cu*1, not visible in the paratype ; fringe amber-yellow. Hind wing and fringe cartridge-buff. Underside of fore wing cartridge-buff, costal area, apex and fringe cream-buff ; the postmedial fascia of the upper side obsolete excepting for a fuscous streak on, and just below, the costa. Under side of hind wing and fringe cream-buff, somewhat lighter in the inner marginal area.

Expanse, ♂♂, 35–36 mm.

1 ♂ (holotype) and 1 ♂ (paratype), 5000 ft., October 1921, North Korintji Valley, S.W. Sumatra (*C. F. & J. Pratt*), ex Joicey collection.

Euproctis ruanda, sp. n. (Pl. I. fig. 12.)

♂.—Palpus, head, and thorax antimony yellow. Antennal shaft warm buff, the pectinations lighter. Abdomen greasy in the type, but apparently antimony-yellow. Pectus and legs warm buff to light buff. Fore wing pale pinkish buff, suffused with sayal-brown and irrorated with fuscous-black over the whole wing except in the basal, costal, and terminal areas and beyond the discocellulars ; an outwardly bowed antemedial fascia, indicated by an absence of the sayal-brown and irroration, from costa at one-third to inner margin at one-third ; a postmedial fascia indicated in the same manner, roughly parallel with the termen, outwardly bowed between veins *M*2 and *Cu*1 ; a terminal line of Naples-yellow, the same colour stretching proximally along the veins almost to the postmedial fascia ; fringe pale pinkish buff. Hind wing and fringe pale pinkish buff, the inner marginal area tinged with Naples-yellow. Under side of both wings, and fringes, whitish ; basal half of costa of fore wing sayal-brown.

Expanse, ♂, 33 mm.

1 ♂ (holotype), Rugege Forest, Ruanda District, Lake Kivu, 8000 ft., December 1921 (*T. A. Barns*), ex Joicey collection.

Euproctis chrysoparypha, sp. n. (Pl. I. fig. 14.)

♂.—Palpus deep chrome. Antennal shaft light buff, pectinations buckthorn-brown. Head, thorax and

abdomen, pectus, and venter light orange-yellow to pale orange-yellow. Legs pale orange-yellow, the tibiae and tarsi light buff. Fore wing light orange-yellow; a white postmedial fascia, bowed outwardly from costa to below vein *Cu* 2, thence slightly oblique outwardly to the inner margin; between the base of the wing and the postmedial fascia there is a suffusion of ochraceous-tawny over the whole area, continued internally, and in a deeper shade, for a short distance beyond the fascia, the portion between veins *M*3 and *Cu*1 reaching nearer to the termen than the remainder; fringe light orange-yellow. Hind wing and fringe light orange-yellow. Under side of both wings, and fringes, pale orange-yellow.

Expanse, ♂♂, 35-36 mm.

1 ♂ (holotype) and 1 ♂ (paratype), Mindanao, Philippines (I. I. Mounsay), ex Joicey collection.

Euproctis macrocera, sp. n. (Pl. I. fig. 11.)

♂.—Palpus porrect, clay-colour mixed with bistre. Antennal shaft long (about 10 mm.), cartridge-buff; pectinations well developed, buckthorn-brown. Head and thorax clay-colour. Abdomen above and beneath fuscous, with clay-colour from the thorax slightly invading the basal segment; anal tuft clay-colour. Pectus and legs clay-colour to tawny-olive. Fore wing antimony-yellow; in the basal half of the wing some scattered bistre scales, a spot of this colour on the costa at one-third and a further spot on the centre of the discocellulars; a bistre postmedial fascia, crenate, points on the veins, concavities terminad, commencing from the costa at two-thirds, running roughly at right angles to the costa as far as vein *M*3, thence oblique inwardly to the inner margin at one-half; a series of subterminal interneural bistre spots, not present above veins *M*1 and *Cu*1, the one above vein *M*2 being the largest; fringe antimony-yellow. Hind wing tawny-olive to Saccardo's-umber; fringe warm buff. Under side of both wings tawny-olive to Saccardo's-umber, the hind wing somewhat darker; some scattered bistre scales in and beyond the cell of the fore wing; fringes warm buff.

Expanse, ♂♂, 42-44 mm.

1 ♂ (holotype) and 1 ♂ (paratype), 27. xi. 1912 and 27. vi. 1913, 7000 ft., Haight's Place, Pauai, subprov. Benguet, Luzon (*A. E. Wileman*).

Euproctis chionobaliu, sp. n. (Pl. I. fig. 10.)

♀.—Palpus drab mixed with whitish. Head and antenna drab, mixed on the shaft with snuff-brown. Thorax snuff-brown; in the tegula a number of up-standing scales with fan-shaped ends. Abdomen above and beneath bistre; anal tuft ochraceous-buff. Pectus drab. Legs whitish, mixed sparsely with drab. Fore wing snuff-brown; a large and conspicuous white antemedial patch reaching from the origin of vein *Cu* 2 to the anal vein, continued narrowly to the inner margin and proximally for a short distance along the anal vein, the area between this patch and the base of the wing bistre; a white postmedial streak running from vein *Cu* 2 at one half oblique inwardly to the inner margin, the area between this streak and the antemedial patch bistre; a spot of bistre on the discocellulars; terminal area whitish, narrowly at the tornus, becoming broader towards the apex, and extending for some distance along the costa; some metallic scales scattered over the wing, slightly raised from the wing-surface; fringe whitish. Hind wing bistre; fringe whitish. Under side of both wings snuff-brown to bistre; fringe whitish, this colour encroaching slightly on to the wing-area and continuing round the apices.

Expanse, ♀♀, 38–42 mm.

1 ♀ (holotype), Minahassa, N. Celebes, 1921 (*P. J. van den Bergh*); 2 ♀♀ (paratypes), N. Celebes, ex Joicey collection.

Probably related to *Euproctis leucospila* Wlkr. (1865), *E. submarginata* Wlkr. (1865), and *E. ateralbus* Roths. (1915), all of which, like the present species, are without vein *R* 5 in the fore wing. It may be necessary to revive Walker's genus *Cozola* for these insects, which are found in Celebes and Ceram, although it should be noted that another species of similar appearance, *E. biplagiata* Wlkr. (1865), has retained vein *R* 5.

Marbla catharia, sp. n. (Pl. I. fig. 9.)

♂.—Palpus whitish, mixed near the tip with drab. Antennal shaft white, pectinations fuscous. Head

whitish, mixed on the vertex with pale orange-yellow. Thorax pinkish buff; a collar of pale orange-yellow at the junction of head and thorax. Abdomen above and beneath, and pectus, whitish, thinly haired. Legs white, mixed on the inner side of tibia of fore leg with fuscous. Fore wing fuscous, semi-hyaline; a fuscous-black spot on the centre of the discocellulars and a further spot on vein *Cu* 2 near its origin; fringe pinkish buff. Hind wing and fringe white. Under side of both wings, and fringes, whitish, on the fore wing the colour of the upper side showing through; costa of fore wing fuscous.

♀.—Resembles the ♂, but with the fore wing rather more transparent and with a very slight admixture of dark hair-scales on the hind wing.

Expanse, ♂♂ 37–41 mm., ♀ 44 mm.

1 ♂ (holotype), Namabale, Uganda, 29. vii. 1929 (*G. L. R. Hancock*), presented by the Imperial Institute of Entomology; 1 ♀ (allotype) and 2 ♀♀ (paratypes), Toro Forest, S.E. Buddu, Uganda, 3800 ft., 29 & 30. ix. 1911 (*S. A. Neave*); 1 ♂ (paratype), Toro, Daro Forest, Uganda, 4000–4500 ft., 29. x. 1911 (*S. A. Neave*); 1 ♂ (paratype), Mahera Forest, Kyagive, Mulange, Uganda, April–August 1919 (*R. A. Dummer*), ex Joicey collection.

Related to *Marbla beni* B.-Bak. (1909), in which the fore wing is whitish.

Dasychira callipluta, sp. n. (Pl. I. fig. 19.)

♀.—Palpus and head fuscous mixed with tawny-olive. Antenna fuscous. Thorax and abdomen snuff-brown, mixed sparsely on the thorax with sage-green. Pectus and venter snuff-brown mixed with fuscous. Legs fuscous, tibiae and tarsi cinnamon-buff marked at regular intervals on the outer side with fuscous. Fore wing tawny-olive; in and above the cell and beyond the cell to the postmedial fascia deep mouse-grey; discocellulars enclosed with a broken ring of fuscous; subbasally below the cell a patch of sage-green, a further patch below the basal third of vein *Cu* 2, and a further conspicuous patch from above the tornus subterminally up to vein *M* 2; a fuscous crenate postmedial fascia, bowed round the discocellulars from

costa to vein *Cu* 2, thence obsolescent; a patch of pale pinkish buff on each side of the postmedial fascia from costa to vein *M* 1, produced between veins *R* 4 and *M* 1 almost to the termen; some fuscous interneural streaks between the postmedial fascia and the termen, the most conspicuous being between veins *R* 5 and *M* 1; fringe tawny-olive marked interneurally with fuscous. Hind wing cinnamon-buff mixed with fuscous; fringe cinnamon-buff, marked interneurally with fuscous except between veins *M* 2 to *Cu* 1. Under side of both wings cinnamon-buff mixed with fuscous; on each wing a fuscous marking on the discocellulars and fairly distinct postmedial and subterminal fasciæ; fringes cinnamon-buff marked interneurally with fuscous.

Expanse 43 mm.

1 ♀ (holotype), Kampala, Uganda, 21. xi. 1931 (*H. Hargreaves*). Presented by the Imperial Institute of Entomology.

Resembles *D. rutilinea* Holl. (1893), but without any trace of the fuscous line running above the anal vein or of the white spot near the tornus.

Dasychira rhabdota, sp. n. (Pl. I. fig. 3.)

♂.—Palpus bistre, lighter at the tip. Antenna imperfect in the type, the shaft apparently fuscous, pectinations bistre. Head and thorax snuff-brown, a line of fuscous centrally down the vertex and patagium, a patch of fuscous laterally from the base of the wing to the eye. Abdomen pinkish buff mixed with snuff-brown; snuff-brown dorsal tufts on the basal segments. Pectus and venter pinkish buff. Fore and middle legs snuff-brown, mixed on the outer side of tibia and tarsus with fuscous; hind leg pinkish buff. Fore wing snuff-brown; a broad fuscous streak running from the base of the wing just below the cell, parallel with the inner margin, reaching the termen above vein *Cu* 1; a further fuscous streak on vein *M* 3, and shorter streaks reaching the termen above and below vein *M* 2; some indefinite fuscous markings near the apex; a wavy fuscous pre-terminal fascia, broken at the veins; a small but distinct white patch just below vein *Cu* 2, midway between cell and termen; fringe snuff-brown, marked interneurally with fuscous; the termen slightly concave opposite

veins *Cu* 1 and *Cu* 2. Hind wing cartridge-buff with a faint line of snuff-brown along the termen; fringe cartridge-buff with a band of snuff-brown in the basal half. Underside of fore wing cartridge-buff, suffused faintly with snuff-brown in the costal half of the wing above the lower margin of the cell and vein *Cu* 2; fringe snuff-brown marked interneurally with fuscous. Under side of hind wing, and fringe, cartridge-buff.

Expanse, ♂, 37 mm.

1 ♂ (holotype), Njala, Sierra Leone, 10. x. 1925 (*E. Hargreaves*). Presented by the Imperial Institute of Entomology.

In Seitz, vol. xiv. pl. xxiii. e, an insect, which is evidently the ♀ of *D. rhabdota*, is wrongly shown as *D. antica* Wlkr. The latter species is a very different insect, with no white spot near the tornus.

Dasychira thysanoessa, sp. n. (Pl. I. fig. 18.)

♂.—Palpus, head, and thorax sepia mixed with tawny-olive. Antennal shaft snuff-brown, pectinations sepia. Abdomen drab; sepia dorsal tufts on the basal segments, anal segments banded distally with sepia. Pectus, venter, and legs drab; on tibiae and tarsi mixed with sepia and snuff-brown. Fore wing Saccardo's-umber mixed with sepia; traces of a fuscous subbasal fascia and of a double antemedial fascia; a rather prominent fuscous streak below the lower margin of the cell, running from the subbasal to the antemedial fascia; a crenate fuscous postmedial fascia, points on the veins, concavities terminad, bowed outwardly from costa to vein *Cu* 2, thence roughly at right angles to the inner margin; an indistinct fuscous preterminal fascia, parallel to the termen, broken at the veins; a white crescent-shaped streak running from vein *Cu* 1 at two-thirds to the inner margin just before the tornus; fringe Saccardo's-umber, drab at the vein-ends. Hind wing whitish; a faint dark patch on the discocellulars and a faint line of Saccardo's-umber along the termen; fringe Saccardo's-umber, whitish at the vein-ends. Under side of both wings whitish, lightly dusted in the costal and apical areas with Saccardo's-umber; a dark patch on the discocellulars and a wavy postmedial fascia; fringes Saccardo's-umber, whitish to drab at the vein-ends.

♀.—Resembles the ♂ in markings, but with a lighter thorax and fore wing and a darker hind wing, the latter being suffused over the whole area with tawny-olive, the veins darker.

Expanse, ♂♂ 32–37 mm., ♀ 41 mm.

1 ♂ (holotype), 1 ♀ (allotype), and 2 ♂♂ (paratypes), at light, June 1926, Nairobi, Kenya Colony (*T. J. Anderson*), Scott Agricultural Laboratories. Presented by the Imperial Institute of Entomology.

Nearest to *D. elæochroa* Collnt. (1931), but smaller, entirely without dull citrine on the fore wing, and differing also in details of pattern.

Dasychira calliprepes, sp. n. (Pl. I. fig. 8.)

♂.—Palpus white, on the outer side fuscous-black. Antennal shaft white, pectinations raw sienna. Head and thorax white. Abdomen raw sienna, the white of the thorax encroaching for a short distance on the basal segments and separated from the raw sienna by a narrow band of fuscous; anal tuft whitish, with a few fuscous hair-scales dorsally at its base. Pectus and legs white, tibiæ and tarsi marked at regular intervals on the outer side with fuscous-black. Venter whitish. Fore wing white, crossed by numerous crenate fuscous fasciæ formed much as in *D. georgiana* Fawc., but more numerous, the wing in consequence having a greyer appearance; discocellulars enclosed by an irregular fuscous-black line; fringe white, mixed with fuscous interneurally. Hind wing white, mixed very heavily, especially on the veins, with fuscous, giving a dark appearance; costal area and fringe white. Under side of both wings, and fringes, white; some faint fuscous irroration near the anal angle of the hind wing.

Expanse, ♂, 45 mm.

1 ♂ (holotype), February 1924, 3000–4000 ft., forest, wet season, Middle Lowa Valley, near Walikali, Belgian Congo (*T. A. Barnes*), ex Joicey collection.

This handsome insect is related to *D. georgiana* Fawc. (1901), but may be distinguished by the darker hind wing, the dark bar across the base of the abdomen, and the absence of fuscous dorsal tufts.

Dasychira semotheta, sp. n. (Pl. I. fig. 1.)

♂.—Palpus Dresden-brown, on the outer side fuscous. Antennal shaft Dresden-brown, the pectinations lighter. Head pinkish buff, with a central line of Saccardo's-umber on the vertex. Thorax pinkish buff mixed with Saccardo's-umber. Abdomen cinnamon-buff, with fuscous dorsal tufts on the basal segments. Legs, pectus, and venter pinkish buff, mixed on the fore leg with Dresden-brown. Fore wing absinthe-green, with the following Saccardo's-umber markings: a somewhat broad line along the costa; a patch filling in the angle between the lower margin of the cell and the anal vein, and reaching just beyond the junction of vein *Cu* 2 with the cell; a large patch on the discocellulars; a crenate postmedial fascia from the costa at two-thirds to the inner margin at two-thirds; a broad subterminal patch parallel with the postmedial fascia, not extending below vein *Cu* 2, produced to the termen between veins *R* 5 and *M* 2; a preterminal interneural series of spots; a broad and conspicuous streak of white running below vein *Cu* 2 from its junction with the cell almost to the preterminal area, crossed by the postmedial fascia and a further line in the subterminal area, the whole having somewhat the shape of a closed hand with a finger pointing towards the middle of the cell; fringe cinnamon-buff marked interneurally with Saccardo's-umber. Hind wing pinkish buff, slightly shaded by an admixture of tawny-olive; fringe cinnamon-buff. Under side of both wings, and fringes, pinkish buff, mixed sparsely in and beyond the cell of fore wing with tawny-olive; fringe of fore wing marked interneurally with Saccardo's-umber.

Expanse, ♂♂, 33–34 mm.

1 ♂ (holotype) and 1 ♂ (paratype), Upper Iowa Valley, near Masisi, W. Kivu, 5000–6000 ft., forest and long grass, wet season, February 1924 (*T. A. Barnes*), ex Joicey collection.

Dasychira embrithes, sp. n. (Pl. I. fig. 7.)

♀.—Palpus, head, thorax, and antennal shaft hair-brown mixed with whitish, giving a grey effect. Pectinations of antenna olive-brown. Abdomen above and

beneath drab, with dorsal fuscous-black tufts on the basal segments. Pectus and legs hair-brown mixed with whitish, the tarsi drab mixed with fuscous-black. Fore wing hair-brown mixed with whitish, marked as follows with fuscous-black: an irregular subbasal fascia; a double antemedial fascia, the proximal portion almost straight and at right-angles to the inner margin, the distal portion outwardly oblique from costa to cell, bowed inwardly across the cell and again bowed inwardly from cell to inner margin; a border surrounding the discocellulars, broader on the proximal side; a crenate postmedial fascia, concavities terminad, points on the veins, bowed strongly round the discocellulars to vein *Cu* 2, thence outwardly oblique to the inner margin; a broad irregular shade midway between postmedial and termen, with a conspicuous triangular mark having one side on vein *Cu* 1 and a point touching the anal vein; a crenate preterminal fascia, broken at the veins, parallel with the termen; a conspicuous whitish patch from the discocellulars almost to the termen, narrowing as it approaches the inner margin; fringe drab, darker at the base, whitish at the vein-ends. Hind wing drab; fringe whitish mixed with drab, hair-brown interneurally at the base. Under side of both wings whitish suffused with drab, with an indistinct drab marking on the discocellulars and traces of a subterminal fascia; fringes of both wings as on upper side.

Expanse, ♀♀, 45–47 mm.

1 ♀ (holotype), 28. vii. 1915, Kashitu, N.W. Rhodesia; 3 ♀♀ (paratypes), 23. iii. 1918 (2) and 7. xii. 1917, Solwezi, N.W. Rhodesia (*H. C. Dollman*).

Dasychira hughesi, sp. n. (Pl. I. fig. 20.)

♀.—Palpus, head, and thorax snuff-brown mixed with fuscous. Antennal shaft snuff-brown mixed with fuscous, pectinations Verona-brown. Abdomen above and beneath, pectus, and legs Saccardo's-umber mixed with fuscous; a band of fuscous laterally on the abdomen and prominent fuscous dorsal tufts on the basal segments. Fore wing snuff-brown mixed with fuscous; traces of a fuscous subbasal fascia; a fuscous antemedial fascia running from the costa at just before one-half to the inner margin at one-half, meeting the latter at

right angles; a fuscous postmedial fascia, irregular, roughly bowed outwardly from costa to vein *Cu* 1, thence bowed inwardly to the inner margin; between antemedial and postmedial fasciæ the space is occupied by scales of pearl-grey and French-grey, giving the appearance of a broad bluish medial fascia; a whitish patch on the discocellulars; a preterminal fuscous fascia, broken at the veins; fringe Saccardo's-umber mixed with fuscous. Hind wing Saccardo's-umber mixed with fuscous, the fringe slightly darker; a broad indistinct fuscous postmedial fascia. Under side of both wings Saccardo's-umber mixed with fuscous, the fringes slightly darker; on the hind wing a dark spot faintly visible on the discocellulars and a double postmedial fascia.

♂.—Resembles the ♀. The wings of the specimen are not in good condition, but appear to be considerably lighter than in the ♀, on both upper and lower sides.

Expanse, ♂ 39 mm., ♀ 54 mm.

1 ♀ (holotype) and 1 ♂ (allotype), 24. xii. 1929 and 24. i. 1930, Dargle, Natal (*W. J. Hughes*).

Mr. Hughes is to be congratulated on finding this striking new species, which seems to have been entirely missed by earlier collectors. Superficially the ♀ somewhat resembles *D. nubifera* Holl. (1893), but the relationship is not close.

Dasychira diplosticta, sp. n. (Pl. I. fig. 5.)

♂.—Palpus, head, thorax, abdomen, and legs buckthorn-brown, palpus on the outer side fuscous, abdomen with a snuff-brown dorsal crest on the basal segments. Antenna buckthorn-brown, the pectinations lighter. Fore wing snuff-brown; a fuscous subbasal streak below the cell; an indistinct fuscous antemedial fascia; a faint fuscous streak on the discocellulars; an irregular and rather indistinct fuscous postmedial fascia, from costa at two-thirds to inner margin at two-thirds, bowed inwardly between *Cu* 2 and the anal vein; a series of interneural spots situated midway between the postmedial and the termen, conspicuous and fuscous in colour from the costa to vein *M* 2, thence whitish to the inner margin; a series of subterminal interneural fuscous streaks; fringe snuff-brown. Hind wing and fringe cinnamon-buff; an indistinct dark spot on the

discocellulars. Under side of both wings, and fringes, cinnamon-buff; a double fuscous spot on the discocellulars of the fore wing and a single spot on the hind wing; traces of a dark postmedial fascia on each wing, and of dark interneural spots near the apices.

Expanse, ♂♂, 37–44 mm.

1 ♂ (holotype) and 6 ♂♂ (paratypes), May 1922, 2700 ft., Kako Tagalago, Central Buru (C., F., & J. Pratt), ex Joicey collection.

Dasychira uilemani, sp. n. (Pl. I. fig. 6.)

♂.—Palpus whitish mixed with drab, on the outer side and beneath bistre. Antennal shaft ochraceous-buff, pectinations ochraceous-tawny. Head and thorax whitish mixed sparsely with drab. Abdomen warm buff, mixed dorsally on the basal and anal segments with fuscous; anal tuft whitish, fuscous above. Legs whitish, tibiæ and tarsi of fore and middle legs marked in a regular manner with bistre. Fore wing whitish irrorated with snuff-brown, giving a grey appearance; traces of a fuscous subbasal fascia; an indistinct crenate snuff-brown antemedial fascia; a rounded patch of white scales on the discocellulars, edged by a broken ring of snuff-brown; a bistre postmedial fascia, irregular, not strongly bowed, from costa at two-thirds to inner margin at two-thirds; a series of interneural subterminal bistre streaks; fringe whitish, marked interneurally with bistre. Hind wing warm buff; an indistinct patch of fuscous on the discocellulars; a broad but not strongly defined fuscous postmedial fascia; fringe whitish, marked interneurally with fuscous. Under side of both wings warm buff; patches of bistre on the discocellulars; traces of postmedial fasciæ, more strongly marked on the hind wing; fringes whitish, marked interneurally with bistre.

♀.—Strongly resembles the ♂, but with a darker fore wing due to an increased irroration of snuff-brown.

Expanse, ♂♂ 43–52 mm., ♀♀ 56–60 mm.

1 ♂ (holotype), 1 ♀ (allotype), 2 ♂♂ and 4 ♀♀ (paratypes), June–July and November–December 1913, 7000 ft., Haight's Place, Pauai, subprov. Benguet, Luzon (A. E. Wileman).

Resembles *D. strigata* Moore and *D. taiwana* Wilem., but at once distinguishable by the light patch on the discocellulars.

Aclonophlebia callista, sp. n. (Pl. I. fig. 15.)

♂.—Palpus orange-buff mixed with Prout's-brown. Antenna fuscous-black. Head and thorax Prout's-brown, with orange-buff at the base of the antenna and between the eye and the thorax. Abdomen above and beneath, pectus, and legs drab mixed with pale orange-yellow. Fore wing Prout's-brown; traces of a whitish subbasal fascia; a sinuate whitish antemedial fascia from costa at one-third to inner margin at one-third; a crenate whitish postmedial fascia, points on the veins, concavities terminad, running roughly at right angles to the costa down to vein *Cu* 1, thence strongly oblique inwardly to below vein *Cu* 2, thence oblique outwardly to the inner margin; just above the anal vein a whitish spot ringed with Prout's-brown, the ring being enclosed by the antemedial and postmedial fasciæ; some rather faint whitish interneural lunules in the subterminal area; on the centre of the discocellulars a small orange-buff spot; fringe Prout's-brown, orange-buff at the vein-ends. Hind wing pale orange-yellow, the veins narrowly Prout's-brown; apical area and costa Prout's-brown; fringe orange-buff, marked interneurally towards the apex with Prout's-brown. Underside of both wings, and fringes, as on upper side, but the colours less bright.

Expanse, ♂, 31 mm.

1 ♂ (holotype), Lowowo Valley, South Lowa District, W. Kivu, 4000 ft., mountain forest, wet season, March 1924 (*T. A. Barns*), ex Joicey collection.

Aclonophlebia rhodosticta, sp. n. (Pl. I. fig. 4.)

♂.—Palpus and antennal shaft mummy-brown, pectinations rather lighter. Head and thorax mummy-brown, with a narrow collar of peach-red, and a ring of the latter colour at the base of the antenna. Abdomen orange-buff; anal tuft mummy-brown. Pectus, venter, and legs mummy-brown, hind leg with a small patch of pale orange-yellow at the junction of tibia and tarsus.

Fore wing white with the following markings in mummy-brown to fuscous: a small basal patch, not reaching the inner margin; a subbasal patch from the costa to just below the cell, and a spot just above the anal vein; a large almost quadrangular patch medially from the costa to the lower margin of the cell, embracing the discocellulars; below the cell an irregular ring-shaped marking from the origin of vein *Cu* 2 to the inner margin; a subterminal fascia, occupying almost the whole of the apical area down to vein *M* 1, thence crenate, points on the veins, concavities terminad, to the inner margin; at the base of the wing a small patch of peach-red, and on the discocellulars a further more conspicuous patch of peach-red; veins *M* 2 to *Cu* 2 faintly tinged near the cell with peach-red; fringe pale orange-yellow, interneurally fuscous, the latter colour extending for a considerable distance on to the wing-surface. Hind wing and fringe pale orange-yellow. Under side of both wings, and fringes, as on the upper side, but the pattern on the fore wing, and especially the peach-red markings, less bright.

Expanse, ♂, 41 mm.

1 ♂ (holotype), February 1924, 5000–6000 ft., forest and long grass, wet season, Upper Lova Valley, near Masisi, W. Kivu (*T. A. Barns*), ex Joicey collection.

Resembles *A. rubripunctata* Weym. (1892), but entirely without fuscous marking on the hind wing and with a larger proportion of white on the fore wing. The ♂ is considerably larger than is usual in the genus.

Ocneria philbyi, sp. n. (Pl. I. fig. 2.)

♀.—Palpus capucine-orange. Antennal shaft Saccardo's-umber, pectinations drab. Head and thorax apricot-buff. Abdomen above and beneath, and pectus, pinkish buff. Legs capucine-orange to apricot-buff, banded on tibiae and tarsi with fuscous. Fore wing drab; veins over the whole wing apricot-buff; some slight fuscous dusting in the basal half of the wing; a light postmedial fascia running roughly parallel with the termen, bordered indistinctly on the proximal side with fuscous and more prominently on the distal side

with a series of internoural fuscous spots; fringe apricot-buff, marked with fuscous interneurally. Hind wing seashell-pink, faintly marked with fuscous near the anal angle; fringe salmon-buff. Underside of both wings, and fringes, seashell-pink to salmon-buff; the costal areas and a line at the base of each fringe apricot-buff; fringe of fore wing marked interneurally with fuscous.

Expanse, ♀♀, 35–39 mm.

1 ♀ (holotype), Jidda, Arabia, 20. vi. 1930; 2 ♀♀ (paratypes), east of Jidda, 21. i. 1931 and 9. iii. 1931 (*H. St. J. B. Philby*); 2 ♀♀ (paratypes), Port Sudan (*N. E. Waterfield*).

Somewhat resembles (in the ♀) *Ocneria rubea* F. (1787), but easily distinguished by the shorter antennæ and absence of a white spot on the discocellulars.

The present series shows much variation, one Port Sudan specimen having an almost unmarked fore wing and the other showing heavy fuscous markings in the basal half. I have chosen as type an intermediate form.

The ovipositor is extruded in all specimens of the series.

EXPLANATION OF PLATE I.

- Fig. 1. Dasychira emotheta*, sp. n., type ♂.
- Fig. 2. Ocneria philbyi*, sp. n., type ♀.
- Fig. 3. Dasychira rhabdota*, sp. n., type ♂.
- Fig. 4. Acinophlebia rhodosticta*, sp. n., type ♂.
- Fig. 5. Dasychira diplosticta*, sp. n., type ♂.
- Fig. 6. — wilemani*, sp. n., type ♂.
- Fig. 7. — embrihes*, sp. n., type ♀.
- Fig. 8. — callipreper*, sp. n., type ♂.
- Fig. 9. Marbla catharia*, sp. n., type ♂.
- Fig. 10. Euproctis chionobalia*, sp. n., type ♀.
- Fig. 11. — macrocera*, sp. n., type ♂.
- Fig. 12. — ruanda*, sp. n., type ♂.
- Fig. 13. Porthesia conizona*, sp. n., type ♂.
- Fig. 14. Euproctis chrysoparypha*, sp. n., type ♂.
- Fig. 15. Acinophlebia callista*, sp. n., type ♂.
- Fig. 16. Euproctis erythropoecila*, sp. n., type ♂.
- Fig. 17. — euthyphers*, sp. n., type ♂.
- Fig. 18. Dasychira thysanoessa*, sp. n., type ♂.
- Fig. 19. — calliphata*, sp. n., type ♀.
- Fig. 20. — hughesi*, sp. n., type ♀.

V.—*Descriptions and Records of Bees*.—CXL.
By T. D. A. COCKERELL, University of Colorado.

Allodape alicæ, sp. n.

♀.—Length about 5 mm.

Head and thorax shining black; legs black, the tarsi more or less rufescent at apex; abdomen broad, dark red, including the apical segments, but first tergite with a very large oval blackened swelling on each side; clypeus with broad upper part and median band (forming a T with long stem and very short thick arms) cream-colour; labrum and mandibles black; flagellum, except basally, obscurely rufous beneath; tubercles margined with creamy-white; tegulæ hyaline, with a yellowish spot. Wings dusky hyaline; stigma very dark reddish, nearly black; nervures pale; basal nervure falling just short of nervulus; second cubital cell short and high, receiving first recurrent nervure at a distance from its base equal to less than half length of first intercubitus; scopa of hind tibiæ thin and white. Abdomen with first three tergites shining, those beyond dullish and thinly pubescent. Hind spur of hind tibia pale and very long. The clypeus is sparsely and weakly punctured; the median band is slightly swollen at the lower end, and does not reach clypeal margin.

Cape Province: Uitenhage, Oct. 30 (*A. M.*).

Related to *A. nigricollis* Friese and *A. nigrescens* Friese. From the first it differs by the black legs, with tarsi not fulvous, and pale tegulæ; from both by the peculiar swellings on first tergite.

Allodape minutissima, sp. n.

♀.—Length 5.4 to 6 mm.

Head and thorax shining black; legs black, with the front and middle tibiæ and tarsi red, and hind tarsi red at end; abdomen clear red, including apex, but first tergite reddish black except the broad apical margin; mandibles black, labrum red; clypeus with a pale yellow stripe, rather broad at upper end (in Uitenhage specimen with narrow lateral extensions), gradually narrowing, fading out a little below middle of clypeus, but continued by an obscure reddish band

to the margin; scape red, marked with black behind; flagellum rather long and slender, obscurely reddish beneath; sides of pronotum, tubercles, and a large lanceolate mark covering most of scutellum light yellow; tegulae reddish, with broad hyaline margins. Wings hyaline, with large clear red stigma and pale reddish nervures; basal nervure falling just short of nervulus; second cubital cell receiving recurrent nervures very near to base and apex. Spurs red; hind tibiae with a long thin scopa of yellowish-white hairs, but both the tibiae and basitarsi have stiff black hair posteriorly.

Compared with *A. alicae*, this at first appears much the same, but it is easily distinguished by the shining yellow mark on scutellum, red scape, and red front tibiae. The first tergite has a pair of elongate depressions, instead of the large dark elevations.

Cape Province: type from Oudtshoorn, Oct. 31 (*L. O.*); also from Uitenhage, Oct. 30 (*J. O.*).

Related to *A. variegata* Smith, but much smaller.

Allodape rufescens, sp. n.

♀.—Length about 5 mm.

Head and thorax shining black; legs black, with the anterior and middle knees, tibiae, and tarsi red, but middle tibiae with a large black mark on outer side; hind tibiae black, with extreme base and apex red; hind basitarsi very long, dusky reddish, small joints of hind tarsi pale; abdomen broad, dark red, including apex, but the first tergite blackened basally, this tergite with a pair of slight, hardly noticeable, depressions; labrum red; scape red in front; flagellum slightly reddish beneath toward end; clypeus shining black, with a poorly defined trilobed dull yellow spot at upper end; upper border of pronotum except in middle, tubercles, and large broad-lanceolate mark on scutellum, all clear yellow; tegulae dark with a broad pale margin. Wings hyaline, stigma dusky red, nervures brown; basal nervure falling just short of nervulus; first recurrent nervure meeting intercubitus. Hind tibiae with glittering pale hair, but stiff black hairs posteriorly on tibiae and basitarsi.

Cape Province: Van Rhyn's Pass, Nov. 21 (*Ckll.*).

This is so near to *A. minutissima* that it may well be only a local race, with the wings not quite so clear, the stigma and nervures evidently darker. The basal area of the metathorax, however, is noticeably shorter.

Allodape bihamata, sp. n.

♀.—Length about 6 mm.

Head and thorax shining black; legs black basally, but knees (including apical half of anterior femora in front), tibiæ, and tarsi red, the hair on hind tibiæ and tarsi pale reddish; abdomen bright clear red, including first tergite, but apical region a little dusky, beneath with a black stain at each side; clypeal mark, sides of pronotum above, tubercles, and broad band on scutellum (boat-shaped in outline) clear yellow; clypeal mark consisting of a median band, swollen above, connected at each end with a transverse band which is extended laterally into curved hook-like points, thus the clypeus may be said to be yellow with a black mark, pointed at each end, on either side; labrum red; scape red in front; flagellum black; area of metathorax large and long; tegulæ dark in middle, with broad hyaline margins. Wings brownish hyaline; stigma dusky reddish, nervures brown; second cubital cell high, receiving recurrent nervures close to and about equally distant from base and apex; first sternite swollen and intense black in middle.

Cape Province: Port Elizabeth, Oct. 29 (*J. O.*).

Allied to *A. melanopus* Cam., but with much more red on legs.

Allodape ogilviei, sp. n.

♀.—Length about or nearly 6 mm.

Head and thorax shining black; legs black basally, knees narrowly red, anterior and middle tibiæ and tarsi red; hind tibiæ dusky red on inner side, outwardly black, with much black hair; hind tarsi with the very long basitarsi dusky reddish, with black hair, the small joints clear red; abdomen bright ferruginous, first tergite black at base, first sternite raised and black in middle, a large black spot at each side of second sternite; labrum red; scape red in front, flagellum black; clypeus red in middle, and with a yellow stripe, broadest on

upper margin, and narrowing to a fine point before the apex; yellow markings of thorax as in *A. bihamata*, except that the mark on scutellum is shorter, with the outline of a broad cup; tegulæ reddish. Wings greyish hyaline, stigma dark brown, nervures brown; second cubital cell receiving recurrent nervures near to and equally distant from base and apex. Area of metathorax shorter than in *A. bihamata*.

Cape Province: Port Elizabeth, Oct. 29 (*J. O.*).

Allied to the last, but easily distinguished by the hind legs. It is also a less robust insect.

Allodape variegata Smith.

Natal: the Bluff, Durban, Oct. 15 (*W. P. C.*).

Allodape lacteipennis Brauns.

Cape Province: Nieuwoudtville, Nov. 22 (*W. P. C.*).

Allodape panurgoides Smith.

Cape Province: Oudtshoorn, Nov. 2 (*J. O.*).

This is *A. crinita* Brauns, which is *A. panurgoides* according to Friese.

Allodape triodontopus, sp. n.

♂.—Length about 7 mm., anterior wing 6.8.

Black, including mandibles, antennæ, and legs, but clypeus, lateral face-marks, labrum, and narrow stripe along posterior orbits reddish yellow, a sort of pale tan-colour; lateral marks narrow below, enlarging at sides of clypeus in the form of a semicircle, but not following the clypeal margin nearly to the top, then forming a narrow band along orbits to about halfway up front (the style thus of *A. marleyi* Ckll., which has a largely red abdomen); eyes large and face rather narrow; pubescence rather scanty, dull white, clear and abundant on thorax beneath; mesothorax highly polished and shining on disc, scutellum dullish; tegulæ brown. Wings strongly reddened, stigma long and narrow, bright ferruginous, the margin somewhat dusky; nervures brown; second recurrent nervure variable, on one side of type almost meeting the outer intercubitus, on the

other side a considerable distance from it, though not so far as first recurrent from base of second cubital cell. Spurs red; hind trochanters beneath with two strong teeth, the second longest, and base of femur prolonged and angulate, so that there is a series of three dentiform processes. Abdomen broad, without bands, second tergite with a brown margin; hair at apex mostly long and white, but the inner tufts black; base of venter strongly keeled, formed like the roof of a house. The shape of the lateral face-marks readily distinguishes this from *A. panurgoides*.

Cape Province: Oudtshoorn, Nov. 2 (*J. O.*).

This and *A. tridentipes* are very much alike in most respects, including the similarly tridentate base of hind legs and the reddish wings, but they differ strikingly in the face-marks, the colour of the pubescence, the venation, and the strongly shining base of metathorax in *A. tridentipes*, that of *A. triodontopus* being dull, somewhat shining at sides.

Allodape tridentipes, sp. n.

♂.—Length about 8.5 mm., anterior wing 7.

Black, including legs, mandibles, and antennæ; clypeus entirely and labrum light orange, but no lateral marks; no stripes behind eyes; clypeus strongly punctured, the upper part parallel-sided, longer than broad; sides of vertex with a large flattened polished impunctate area; disc of mesothorax polished and impunctate, scutellum finely punctured; base of metathorax shining, except the basal middle, which is depressed and dullish; hair of head, thorax, and legs (very conspicuous on mesopleura) bright copper-red, the colour is very brilliant on apical part of hind tibiae posteriorly; tegulae brown. Wings strongly reddened, the long narrow stigma very dark reddish, the nervures dark; basal nervure meeting nervulus; second cubital cell rather short, receiving first recurrent nervure a moderate distance (not or hardly equal to half first intercubitus) from base, and second more remote from apex. Spurs red; hind legs tridentate at base as in *A. triodontopus*. Abdomen broad, glistening, not banded, hair at apex black.

Cape Province: Doorn River, near Camfer, Nov. 3 (*Ckl.*).

It is difficult to resist the idea that this is the male of *A. punctata* (Lep. & Serv.), which was also taken (♀) at Doorn River (*A. M.*). The female *A. punctata* is larger, but has exactly the same red hair on head, thorax, and legs, but the face has three orange stripes, the scutellum is orange, there is an orange stripe along posterior orbits, the basal nervure falls short of nervulus, and the first recurrent nervure reaches the second cubital cell at a distance equal to much more than half of first intercubitus. Thus it seems better to describe the male as a distinct species, although the examination of a series of the related *A. panurgoides* tends in some respects to support the association of the sexes. Male *A. panurgoides* has an orange clypeus, but also lateral face-marks, while the female has three orange stripes. The scutellum is entirely black in both sexes, and both sexes have a stripe along posterior orbits, though it may be very weak or thin in the male. The basal nervure varies from meeting the nervulus to falling a little short of it. The position of the first recurrent nervure varies, being more remote from the base of the second cubital cell in the females. The bright red patch of hair on hind tibiae, which might be cited as an argument for associating *A. tridentipes* with *A. punctata*, is equally present in *A. panurgoides*, and also in *A. hirsuta* Brauns. *A. punctata* is very closely allied to *A. cordata* Smith, but the wings are redder and the second cubital cell is longer.

Allodape monticola, sp. n.

♀.—Length about 5 mm.

Shining black, with very little pubescence; no light marks on face, cheeks, or region of mouth; clypeus produced, polished, with scattered extremely minute punctures, the upper part with an excessively minute tessellate and lineolate sculpture; scape mainly red on under side, flagellum black, very faintly brownish beneath; a shining elevation in front and at sides of middle ocellus; mesothorax and scutellum highly polished, middle of scutellum with a large yellow spot; upper border of prothorax with one or two small yellow spots at each side, and tubercles yellow; tegulae dark reddish. Wings perfectly clear, iridescent; stigma large, reddish brown, not dark-margined; nervures

brown; basal nervure falling conspicuously short of nervulus; second cubital cell high, receiving recurrent nervures not far from base and apex. Hind tibiae with abundant white hair; anterior tibiae red in front; tarsi rufous apically. Abdomen shining, with a very minute sculpture of transverse lines; hind margins of tergites obscurely reddish. The area of metathorax is large, with a dull surface.

Cape Province: mountain near Calvinia, Nov. 16 (J. A.).

A very distinct species, allied to *A. lacteipennis* Brauns, but easily known by the entirely black face, spot on scutellum, and colour of stigma. Friese (1924) describes female *A. lacteipennis* as having the clypeus all black, but Strand (1914) refers to the transverse mark on upper end of clypeus, and this agrees with my specimens from Brauns. Apparently the *A. basizona* Friese of Friese's table (but not otherwise described) is *A. lacteipennis*. Friese writes "*lactipennis*," but Brauns wrote *lacteipennis*, and Strand has it so.

Allodape albipes, sp. n.

♂.—Length about 4.5 mm.

Black, shining, with narrow face and very scanty white hair; clypeus, labrum, and large spot on mandibles white with a slight creamy tint; lateral marks represented by very small elongate spots, not touching clypeus or orbit, opposite the point where clypeus broadens below; scape all black, flagellum long, dusky red beneath; no stripe on posterior orbits; mesothorax polished on disc, scutellum dullish, area of metathorax large and dull; no light marks on thorax, except that the tubercles are white-margined; tegulae pale testaceous; a black spot on base of wings. Wings clear hyaline; stigma large, elongate, pale brown, with darker margin; veins pale; basal nervure falling considerably short of nervulus; second cubital cell receiving recurrent nervures close to base and apex. Legs shining black, with the tarsi white, the small joints more or less reddish. Abdomen broad, without bands, the long hair at apex white.

Cape Province: Graaff-Reinet, Oct. 26 (J. O.).

Extraordinarily similar to *A. albitalis* Friese, which, however, comes from Eritrea, and has the scape light

in front and the tibiae brown at end. In the S. African fauna it comes close to *A. elizabethana* Brauns, but is easily separated by the white tarsi and white instead of yellow clypeus.

Allodape luckhoffi, sp. n.

♀.—Length about 4.5 mm.

Black, including labrum and mandibles, shining, with very scanty white hair; clypeus with a light yellow T-shaped mark, its upper margin concave, its lateral extensions very short and broad, anteriorly with a small notch between them and the thick stem, which narrows for a distance, but has an enlarged rounded end; antennae black; mesothorax and scutellum polished, base of metathorax dull; thorax all black, except that the tubercles are margined with light yellow; tegulae brown. Wings hyaline, slightly greyish, nervures pale; stigma dark brown, the thick margin darkest; basal nervure falling a little short of nervulus; second cubital cell receiving recurrent nervures near base and apex. Legs black, with white hair, tarsi obscurely reddened at end. Abdomen broad, without bands, hind margins of tergites obscurely brownish.

Cape Province: Graaff-Reinet, Oct. 26 (*J. O.*).

It would be natural to regard this as the female of the very similar *A. albipes*, from the same place, but the conspicuously shorter, dark stigma appears to make this impossible. The clypeal mark is much better developed than in *A. elizabethana*. I have named the species after Robert Luckhoff, of Graaff-Reinet, who has made important discoveries in vertebrate paleontology, and is also an authority on the succulent plants of the region.

Allodape wilmatta, sp. n.

♂.—Length about 6 mm., anterior wing 4.5.

Black, including mandibles and antennae (except yellow stripe on scape); pubescence white; tongue very long; clypeus with a large light yellow anchor-shaped mark, the upper margin (on upper margin of clypeus) straight, the sides above with dagger-shaped extensions downward, the stem thick and parallel-sided,

and a very broad base including the apical or marginal region of the clypeus, the transverse band in this region somewhat broader than the central stem; middle of labrum yellowish white; disc of mesothorax polished and shining, but scutellum entirely dull, microscopically tessellate; tegulae brownish black. Wings hyaline, slightly brownish; stigma very dark, obscurely reddish; nervures dark, basal nervure falling a little short of nervulus, second cubital cell receiving first recurrent nervure at extreme base, but second some distance from apex. Legs black, with rather copious white hair; spurs pale reddish, hind spur of hind tibia very long; posterior femora and trochanters not modified. Abdomen without bands, the apical part thinly white hairy, and the long hair at apex white.

Angola: Capeio (or Kapeio), July 22 (*W. P. C.*).

Recognized by the clypeal mark, which resembles that of *A. rolini* Vachal, from which *A. wilmatiae* differs by the total lack of yellow markings on thorax.

Allodape angolensis, sp. n.

♂.—Length 6.5 mm., anterior wing 4.5.

Black, including mandibles and antennae; pubescence white; labrum and mark on clypeus yellow; clypeal mark T-like, but with a broad triangular base (on apical part of clypeus), the median stem broad, thicker above, the upper margin slightly concave, the lateral extensions at upper end short, with a sharp point directed downward; mesothorax polished, but scutellum entirely dullish, and base of metathorax opaque; tegulae dark brown, the margins paler. Wings brownish hyaline, stigma slender, almost black, nervures dark; basal nervure falling short of nervulus; second cubital cell receiving recurrent nervures a moderate and about equal distance from base and apex. Thorax entirely without light markings, but with much greyish-white hair at sides. Legs black, with white hair, on hind basitarsi a little stained with yellowish apically; hind trochanters simple, but hind femora with a very prominent angular projection beneath at base. Abdomen without bands, but hind margins of tergites very narrowly brownish; long hair at apex white.

Angola: Capeio, July 22 (*Ckl.*).

Related to *A. diloloensis*, but not its male, the stigma being smaller, the veins darker and stronger, and the second cubital cell much broader on marginal. Also, the clypeal mark is strongly yellow, but cream-coloured in *A. diloloensis*.

Allodape diloloensis, sp. n.

♀.—Length about 6.5 mm., anterior wing 5.

Black, including mandibles, labrum, antennæ, and legs (small joints of tarsi rufous); pubescence white, thick and abundant on hind legs, ferruginous on inner side of apical part of hind basitarsi; hind spurs pale and very long; clypeus with a broad cream-coloured T-mark, the upper side (base of clypeus) concave, the upper lateral extensions very short but broad, the downwardly directed points small, the median stem thick above and below, more constricted in middle; disc of mesothorax polished; scutellum and base of metathorax dull; tegulæ dark brown; no light marks on thorax. Wings brownish hyaline; stigma large, rufous with a dark margin; nervures pale and slender; basal nervure falling short of nervulus; second cubital cell receiving recurrent nervures near to and equally distant from base and apex. Anterior and middle tarsi with light ferruginous hair on inner side. Abdomen broad, hind margins of tergites narrowly brown.

Belgian Congo: Dilolo, July 24 (J. O.).

Very near what I have determined as *A. nigricollis* Vachal, but that has a clear red stigma and other differences. Vachal, in his description, does not mention the stigma, so there is a little doubt about the application of the name. I assume, lacking any evidence to the contrary, that my original determination was correct.

VI.—*The Taxonomy of Lyperosia exigua De Meijere (Diptera, Muscidae)*. By I. M. MACKERRAS, B.Sc., M.B., Ch.M., Commonwealth Council for Scientific and Industrial Research, Canberra.

MR. J. R. MALLOCH has recently (1932) described an Australian fly as *Hæmatobia (Hæmatobia) australis*, sp. n. This fly is an important pest of stock in Australia, where it is known as the "Buffalo Fly." It has been determined

by Australian entomologists as *Lyperosia exigua* de Meij., and believed by them to have been introduced into northern Australia from Timor in the early days of settlement (Hill, 1917; Tillyard, 1931). Since the publication of Mr. Malloch's description I have reviewed our material from Australia and the Netherlands Indies, in order to establish whether or not we were in error in believing that we were dealing with an introduced pest, and also, if possible, to settle what name should be used for this insect.

I am indebted to Mr. Anthony Musgrave, of the Australian Museum, Sydney, for extracts from some of the earlier authors, which were not available at Canberra.

The Generic Name Lyperosia.

The genus *Lyperosia* Rondani, 1856 (Dipt. Ital. Prod. i. p. 93) was monotypic for *Conops irritans* Linné. There is no doubt about the identity of the genotype or that *L. exigua* de Meijere is congeneric with *L. irritans* (Linné). The question is whether *Lyperosia* is a valid genus or whether it is a synonym of *Hæmatobia*.

The genus *Hæmatobia* was proposed by Lepeletier de Saint-Fargeau et Audinet-Serville in 1828 (Encycl. Méthod. x. 2, p. 499). It originally contained two species, which were identified by the authors as *Stomoxys stimulans* Meigen (= *S. irritans* Fabr.) and *Stomoxys irritans* Meigen (= *Conops irritans* L. ; = *S. pungens* Fabr.). They attribute the genus to Robineau-Desvoidy, but the latter's description was not published until 1830 (Essai Myod. p. 388).

Westwood comments on the genus *Hæmatobia* as follows :—" *HÆMATOBIA* Desv. *Stomoxys* Meig. 2 sp. *S. irritans* L. Meig. t. 38. f. 8" *.

On this basis Coquillett (1910), followed by Bequaert (1930) and Malloch (1932), accept *Conops irritans* Linné as the genotype of *Hæmatobia* St. Fargeau et Serville by designation of Westwood. *Lyperosia* Rondani, having the same genotype, is treated by them as an absolute synonym of *Hæmatobia*.

* Throughout Westwood's synopsis the first line of each genus comprises the following particulars :—(1) Name of the genus ; (2) name of its founder ; (3) synonym of the genus ; (4) author of the synonymical genus ; (5) number of British species ; (6) typical species ; (7) reference to the best figure.

Bezzi (1912) and Enderlein (1929) object to Coquillett's action, chiefly on the ground that the *Stomoxys irritans* of the older French authors was not the species of Linné but that of Fabricius, which is actually *Stomoxys stimulans* Meigen. They therefore consider that the type of *Hæmatobia* St. Fargeau et Serville was *irritans* Fabr. nec Linn. (= *stimulans* Meig.). Colour is lent to their view, and to the suspicion that Westwood actually had *S. stimulans* Meigen before him, and not *C. irritans* Linné, by the fact that the former species is much more common in Britain (Austen, 1906) and that the figure to which Westwood refers is not *S. irritans* Linné.

Unprofitable argument about the identity of the genotype could be continued indefinitely. Fortunately, however, one point settles the matter. It is clear, from the statement quoted above, that the *Hæmatobia* listed by Westwood is that of Desvoidy. *Hæmatobia* Robineau-Desvoidy is a homonym of *Hæmatobia* St. Fargeau et Serville, and its genotype is not important. Coquillett cannot be construed as having himself designated the type of *Hæmatobia* St. Fargeau et Serville; this was done by Bezzi (1912) in the following terms:—"Espèce type: *Stomoxys stimulans* Meigen, 1824 (*irritans* Fabricius, nec Linné)." We must therefore revert to the usage of Bezzi, applying the name *Hæmatobia* to the group of species which includes *stimulans* Meigen and *Lyperosia* to that group of which *irritans* Linné is the type.

I do not propose to discuss here the validity of the subgenera into which Malloch has divided *Hæmatobia* and *Lyperosia*, but would merely point out in passing certain changes in nomenclature which become necessary. The subgenus *Hæmatobia* Malloch becomes a synonym of *Lyperosia* Rondani, the subgenus *Lyperosiops* Malloch becomes a synonym of *Hæmatobia* St. Fargeau et Serville, the subgenus *Bdellolarynx* (*Bdellolarynx*) becomes *Hæmatobia* (*Bdellolarynx*), and the subgenus *Bdellolarynx* (*Hæmatobina*) becomes *Hæmatobia* (*Hæmatobina*).

Lyperosia exigua de Meijere.

The material available for comparison comprises several hundred specimens from Java and the Lesser Sunda Islands and from Australia, as well as a small series from the Andaman Islands kindly forwarded by the

Imperial Institute of Entomology. I have not seen specimens from India. Java being the type-locality, particular attention was paid to a study of specimens from that island.

The chief characters relied on by Malloch to separate *L. exigua* de Meij. from *L. australis* Mall. were the presence of a short median posterior bristle on the mid-tibia and the paler thoracic bristles in the former species. Other characters noted were the presence of a short outstanding setula near the middle of the ventral surface of the fore-tibia in the males, a less distinct basal bristle on the hind femur, and a somewhat different arrangement of the antero-ventral and postero-ventral bristles of the mid-femur in *L. australis* Mall. None of these characters hold good when a long series is examined. For example, the mid-tibial bristle was absent in all specimens from Australia, present in only three from the Sunda Islands (one from Buitenzorg, one from Soerabaya, and one from Bali, all males), and present in five out of the six specimens from the Andaman Islands. The majority of the specimens from all localities had dark thoracic bristles, but pale specimens could also be found, and a series could easily be picked out showing all gradations between the two, just as Bezzi observed with *L. irritans* Linn. The bristle on the fore tibia has only been found in specimens from Australia, and then only occasionally. The specialized bristles of the hind tarsi of the males are similar throughout, and an examination of the male genitalia proved of no assistance.

The commonest form in Java, which I believe to be the typical *L. exigua* as described by de Meijere, is *L. australis* Mall. The pale variation, that described by Brunetti as *L. flavohirta* Brun. and determined by Malloch as *L. exigua* de Meij., is certainly not a subspecies in the accepted sense of the word, and is, in my opinion, very doubtfully worthy of even varietal rank. Both forms occur in approximately similar proportions in the Sunda Islands and in Australia; the specimens from the Andamans, however, are rather darker, slightly more robust, and have better developed bristles. The development of the mid-tibial bristle is not associated with the colour-form, but may possibly be an expression of a geographical variation from south to north.

Apart from morphological evidence that the *Lyperosia* from Java is identical with that from Australia there is strong evidence for the belief that the fly was introduced into Australia. This evidence may be briefly summarized as follows :—

1. The hosts of the fly in Australia are buffaloes, cattle, and horses. Man is only occasionally attacked, when the flies are disturbed by working the cattle, and Mr. T. G. Campbell failed to induce it to attack native mammals either in the open or in cages.
2. The exclusive breeding-ground so far discovered in nature is the faeces of buffaloes and cattle. In Mr. Campbell's experiments with the faeces of marsupials development of the larvæ could only be obtained under conditions which occur but rarely in the field.
3. The fly was almost certainly originally associated with the introduced buffaloes, and has spread with cattle movements in a way which one could hardly have imagined a native insect would have done. This gradual spread throughout northern Australia is well shown in Mr. Campbell's map (in Tillyard, 1931).

Lyperosia irritans Linné.

I am indebted to the Imperial Institute of Entomology for a series of this species for comparison with *L. exigua* de Meij. The two have been generally considered to be distinct, an opinion with which I concur, but they are very closely related, and most of the characters which have been used for their separation break down when examined on a long series of specimens.

So far as I can discover, the only definitely reliable character is the arrangement of the bristles on the hind tarsi of the males. The differences in these bristles are well shown in Malloch's figures 17 and 18. Another useful character is the colour of the palpi of the female; these are generally fuscous in *L. irritans* and yellow in *L. exigua*; but Bezzi records a variety of *L. irritans* with yellowish palpi, and I have seen occasional specimens of *L. exigua* with more or less fuscous palpi in the female. As pointed out by Bezzi, the acrostichal bristles tend to be more regularly arranged in fewer rows in *L. exigua*

than in *L. irritans*, but this is by no means invariably so; also the basal bristle on the hind femur is usually longer and stronger in *L. irritans* than it is in *L. exigua*. I have not found the differences in the frontal hairs mentioned by Malloch to hold good in the specimens before me. The male genitalia are similar in the two species, but this is not unexpected, since *L. minuta* Bezzi, and even *Stomoxys calcitrans* Linn., differ from *L. exigua* and *L. irritans* only in minor points.

Taking into account the sum of all the characters, the different regional distribution and the slightly different habits of the two species, one is, I believe, justified in regarding them as distinct. It would be interesting to know whether any mixing of the two occurs at the margin of the Oriental and Palearctic regions, and whether they are fertile *inter se*, as M. J. Mackerras has shown in this laboratory to be the case with *Lucilia cuprina* and *L. sericata*.

Distribution of L. exigua de Meijere.

Lyperosia exigua de Meij. was originally restricted to the Oriental Region. It is known from India (*Brunetti*, *Malloch*), the Andaman Islands (*Hennessey*), Sumatra (*Bubberman*), Java, many localities (*Mackerras*, *Windred*, *Handschin*), Bali, Lombok, Soembawa, Flores (*Handschin & Windred*), Soemba, Savoe, Roti, Timor, and Celebes (*Handschin*). Unless otherwise indicated, the records are of Mackerras and Windred. I have no records from the Moluccas or from New Guinea. Hill (1923), however, records *L. exigua* as having been introduced into New Britain, and Ferguson (1923) records it from the Solomon Islands.

In Australia *L. exigua* is widely distributed in the Northern Territory and in the Kimberley District of Western Australia over an area bounded on the south by the 20" rainfall line, beyond which it does not appear capable of living. It has recently extended into Queensland, and its last recorded distribution in that State (June, 1931: Mackerras and Campbell) was over an area bounded approximately by the Leichardt River on the east and by the 19th parallel of south latitude on the south.

REFERENCES.

- AUSTEN, E. E. 1906. "Illustrations of British Blood-sucking Flies." Brit. Mus. Nat. Hist. Publ. 74 pp. (1906).
- BEQUAERT, J. 1930. "Medical and Economic Entomology." Rep. Harvard African Exped. xxxvi. pp. 797-1001 (1930).
- BEZZI, M. 1912. "Études systématiques sur les Muscides hématophages du genre *Lyperosia*." Arch. d. Parasitol. xv. 1, pp. 110-143 (1912).
- COQUILLETT, D. W. 1910. "The Type-species of the North American Genera of Diptera." Proc. U.S. Nat. Mus. xxxvii. no. 1719, pp. 499-647 (4 Aug. 1910).
- ENDERLEIN, G. 1929. "Über die Klassifikation der Stomoxinæ (blutsaugende Musciden) und neue Arten aus Europa und Afrika." Zeitschr. f. angew. Entom. xiv. 2, pp. 356-368 (1929).
- FERGUSON, E. W. 1923. "The Distribution of Insects capable of carrying Disease in Eastern Australia." Proc. Pan-Pacific Sci. Cong. 1923, ii. pp. 1477-1486.
- HILL, G. F. 1917. "Some Notes on the Bionomics of the Buffalo-fly (*Lyperosia exigua* de Meijere)." Proc. Linn. Soc. N.S.W. xli. 4, pp. 763-768 (25 Oct. 1917).
- HILL, G. F. 1923. "The Buffalo-fly in North Australia." Proc. Pan-Pacific Sci. Cong. 1923, i. pp. 409-411.
- MALLOCH, J. R. 1932. "Exotic Muscaridæ (Diptera).—XXXVI." Ann. & Mag. Nat. Hist. (10) ix. no. 54, pp. 501-518 (June 1932).
- TILLYARD, R. J. 1931. "The Buffalo-fly in Australia." J. Coun. Sci. Ind. Res. Aust. iv. 4, pp. 234-143 (Nov. 1931).
- WESTWOOD, J. O. 1840. 'An Introduction to the Modern Classification of Insects, etc.—II. Synopsis of the Genera of British Insects,' p. 140.

VII.—Notes on *Gammarus zaddachi* Sexton from Essex, with Observations on Eye-variations in this Species. By RICHARD PALMER, Dept. of Zoology, University College, London.

GAMMARUS ZADDACHI was first described as a new species by Sexton from preserved specimens in collections from North Germany and the Irish Lakes (Proc. Zool. Soc. Lond. 1912, ii.). Later the same author (Schrift. d. Physik.-ökonom. Ges. z. Königsberg, liv. 1, 1913) recorded further localities from a collection in the Königsberg Museum. These two papers include records from water varying in salinity from fresh to marine, and from localities including the Danziger Bucht, the mouths of the Elbe, Weser and Oder; Memel, Kiel, Norway, the Crimea, and the Irish lakes.

Mrs. Sexton described her specimens with her customary accuracy and attention to detail, but her description was

necessarily confined to characters observable in preserved specimens. Since I have rediscovered the species in this country, it seems desirable to amplify her description by an account of the living animal.

Gammarus zaddachi occurs in large numbers, together with *G. duebeni*, in a shallow brackish-water dyke behind the sea-wall at Tollesbury, Essex. The water has a specific gravity of 1.016, i. e., it consists of sea water and fresh water in roughly equal proportions. Sexton divided her specimens into a fresh-water and a brackish-water type, as she found an approximate agreement between certain superficial characters and the salinity of the habitat. Her fresh-water specimens were usually broader, with a thicker, more hairy cuticle, and with the basal joints of the hinder peræopods narrower than in brackish-water specimens. My examples are all, as might be expected, of the brackish-water type.

In very few points do my specimens differ structurally from Sexton's admirable account. The relation of head-length to that of the first two peræon-segments is, in them, a rather variable character. The setæ of the antennular peduncles are, as a rule, less fully developed. The relative length of the peduncles of the two pairs of antennæ, and the relation between the lengths of peduncle and flagellum of the 2nd antenna are rather inconstant characters, especially in large specimens. With these partial exceptions, the Tollesbury examples agree strictly with those described by Sexton.

The colour-characters are as follows:—The ground-colour of the body is normally a transparent greenish yellow or yellowish green, varying sometimes to yellow or pale green. The hinder edge of each segment, especially on the dorsal side of the pleon, is usually brown. There are also, as a rule, brown bands on the two pairs of antennæ, the peræopods, and the uropods. The patches of fat at the sides of the pleon are a dark purplish red in the males and in some females, and are made up of droplets far smaller than those of, say, *G. chevreuxi*, being indistinguishable as separate drops with a magnification of 20.

The eyes normally possess the black ommatidia usual in the genus, but the amount of white interfacetary pigment is very variable. In some cases it is reduced to a thin

reticulation approaching the condition in *G. duebeni*, but, as a rule, there is ample white pigment as in *G. chevreuxi*.

The species is difficult to breed in the laboratory, partly on account of cannibalism and partly owing to a tendency to sterility under laboratory conditions, which has so far been difficult to overcome. However, some information as to the breeding-habits has been obtained from females which had eggs when caught or which laid them shortly after capture. At a day temperature of 18° C. about a fortnight elapses between egg-laying and extrusion of young, and the average brood number in five females observed was 19. This last point is a further character-difference from *G. locusta*, in which very many small eggs are laid. Sexton (Journ. Mar. Biol. Ass. xiii.) records a brood of 143 in this species.

An interesting feature of *G. zaddachi* is the variation that sometimes occurs in the black pigment of the eye. Among five or six hundred specimens examined one female was found with red eyes. This reduction of the black pigment of the eye is, of course, found in considerable variety in *G. chevreuxi*, where the numerous genes involved have been closely studied by Mrs. Sexton and others. A new eye-variation of interest has, however, been found in *G. zaddachi*. In four specimens taken, about six ommatidia in the centre of the eye were bright red and the others were black. These ommatidia are those present at extrusion. It resembles the *mosaic eye* of *G. chevreuxi* (Sexton, Journ. Mar. Biol. Ass. xviii.) in affecting ommatidia individually, but differs from it in showing a definite relation between the ommatidia that darken and a certain period of development. It is, in short, what Goldschmidt calls in another connection "a mosaic in time."

The coincidence of the initiation of melanin deposition with the commencement of feeding suggests the absence of a melanin precursor in the eggs which develop into these individuals, a deficiency which is then made up from the food. If this is so, one is tempted to suppose that these specimens are heterozygotes from red-eyed mothers, and that red-eyed individuals are unable to deposit a melanin precursor in either their eyes or their eggs. A somewhat similar process affecting the red pigment

of the eye has been described in *G. chevreuxi* by Sexton and Pantin ('Nature,' cxix. 1927).

In view of the very tentative nature of this hypothesis, and of the absence of experimental evidence, it would be futile to discuss more fully the numerous arguments which might be adduced for and against it. A discussion of its bearing on Spooner's cautious suggestion (Journ. Mar. Biol. Ass. xviii. p. 352) that in certain *G. chevreuxi* mutants a melanin precursor may act as a limiting factor would also be premature. Attempts to breed these peculiar varieties of *G. zaddachi* have so far failed, owing to the cannibalism and sterility mentioned above, but it is hoped to return to the problem when more ample material is available. A study of the reaction of the animal to changes in salinity would also be of interest.

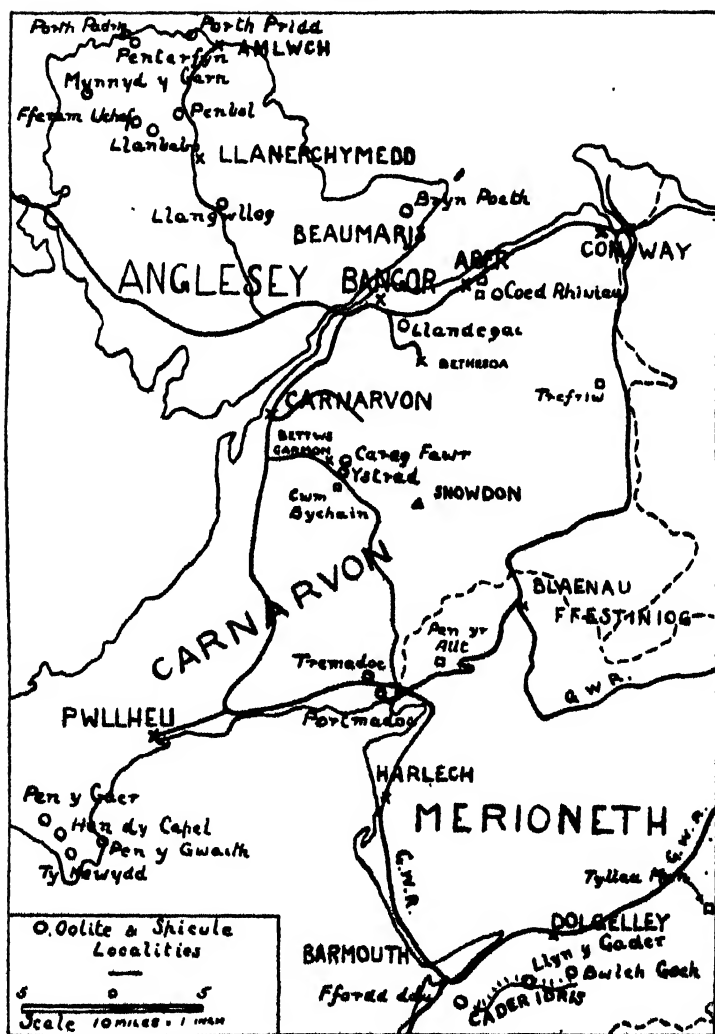
VIII.—*Note on the Occurrence of Sponge-spicules associated with the Iron-ores of North Wales.* By WILLIAM PULFREY, M.Sc., Ph.D.

[Plate II.]

SEVERAL authors have made microscopic investigations of the oolitic iron-ores of Anglesey, Carnarvonshire, and Merionethshire, in North Wales (1), but little record has been made of the almost universal presence of sponge-spicules in them. Similarly, there are but the scantiest of records of sponge-remains in ores abroad. Cayeux (2) records them from the Callovian ore of La Voulte, Ardèche, and mentions (3) that spicules occur most often in non-oolitic rocks. *Receptaculites* has been found near to the Clinton ore of U.S.A. (Oneida County) (4), but apparently spicules of other sponges have not been found. In ores and their associated beds from twenty-eight localities in North Wales, I have found those from twenty-one localities to contain spicule-remains.

The iron-ores occur at widely scattered localities, and at several horizons. The localities where spicules have been found along with the ores have been indicated on the map, text-fig. 1. Their horizons are as follows

Text-fig. 1.



Iron-ore and sponge-spicule localities in N. Wales.

(the numbers in brackets refer to the six-inch maps of the districts):—

- (1) Upper Cambrian (Maentwrog Beds): Carog Fawr and Ystrad, Bettws Garmon (Carnarvonshire 16 S.E.).
- (2) Arenig: (1) Ty Newydd and (2) Pen y Gwaith, St. Tudwal's (Carn. 45 S.W.).
- (3) Llanvirn: (1) Bryn Poeth, S.E. Anglesey (Angl. 15 N.W.). Zone of *Didymograptus murchisoni*.
 (2) Penrhyn Mine, Llandogai (Carn. 7 S.W.).
 (3) Coed Rhiwiau, Aber (Carn. 7. N.E.).
- (4) Llandeilian: (1) Tremadoc Iron Mine (Carn. 34 S.E.). Zone of *Nemagraptus gracilis*.
 (2) Ynys Calch, Portmadoc (Carn. 34 S.E.). Zone of *N. gracilis*.
 (3) Hen dy Capel, Llanengan (Carn. 45 S.W.). Zone of *N. gracilis*?
 (4) Pen y Gaer, Llangian (Carn. 45 S.W.). Zone of *N. gracilis*?
 (5) Mynydd y Garn, N.W. Anglesey (Angl. 2 S.W.). Zone of *Glyptograptus teretiusculus*.
 (6) Penbol, Central Anglesey (Angl. 7 N.W.). Zone of *G. teretiusculus-N. gracilis*.
 (7) "Lano Quarry," Llanbabo, Anglesey (Angl. 6 S.E.). Zone of *N. gracilis*.
 (8) Penterfyn, N. Anglesey (Angl. 2 N.E.). Zone of *N. gracilis*.
 (9) Porth Pridd, W. of Amlwch (Angl. 3 N.W.). Zone of *N. gracilis*.
 (10) Fferam Uchaf, Central Anglesey (Angl. 6 N.E.). Zone of *N. gracilis*.
 (11) Llangwilog, Central Anglesey (Angl. 13 S.W.). Zone of *N. gracilis*.

- (12) Cross Foxes, Cader Idris (Morioneth 37 N.E.). Zone of *Glyptograptus teretiusculus*.
- (13) Bwlch Goch, Cader Idris (Mer. 37 N.E.). Zone of *G. teretiusculus*.
- (14) Llyn y Gader, Cader Idris (Mer. 37 S.W.). Zone of *G. teretiusculus*.
- (15) Ffordd Ddu, Cader Idris (Mer. 36 S.E.). Zone of *G. teretiusculus*.

The spicules from Anglesey are as a rule rather poorly preserved, though they are quite distinct. The best-preserved spicules have been found at St. Tudwal's, Bettws Garmon, Aber, and Tremadoc.

The spicules are occasionally visible to the naked eye, but can be studied only in thin section under the microscope. There are four modes of occurrence:—(1) most frequently in nodules, enclosed in the iron-ore oolite; (2) occasionally in shaley or mudstone beds interbedded with the oolites; (3) very rarely as nuclei in the ooliths; (4) very rarely in the matrix of the ooliths.

Nodules occur in most of the deposits. They are of variable nature. Some have a pale to dark brown isotropic base, generally containing numerous small inclusions of quartz, chlorite, carbonate, or magnetite. Other nodules are of a more argillaceous nature. Ooliths are frequently enclosed by, and occasionally make up the greater part of the nodule. Most often, however, the ooliths are widely separated and uncorroded, in contradistinction to the close-packing and corroded edges of the ooliths in the matrix. Occasionally the nodule has feeble agate structure. Many of the nodules have a cleat-like parting which does not pass into the ore. In some cases the nodules have moderately well-defined margins; others, e. g., those of Bettws Garmon, have no definite boundary and the nodule merges into the matrix. When spicules are opposed to the margins, they do not cross it, but break off sharply. Most of the spiculiferous nodules weather with a thin bluish-white crust.

The spicules are rarely preserved in silica, and more often are replaced by chlorite or siderite, and occasionally partly or entirely by pyrite. The axial canal can often

be distinguished. One spicule from Bryn Poeth, Anglesey, has a moniliform canal (text-fig. 2, 20).

The presence of sponge-spicules in the iron-ores is probably some indication of the conditions of deposition of the ores. The nodules in which the spicules occur have been considered as indication of pene-contemporaneous erosion (5, Cox, 1925, p. 556). But few, if any, of the nodules are true pebbles or galls. The occurrence of spicules as oolith-nuclei and in the inter-bedded mudstones points to the contemporaneity of the nodule-formation and ore-deposition.

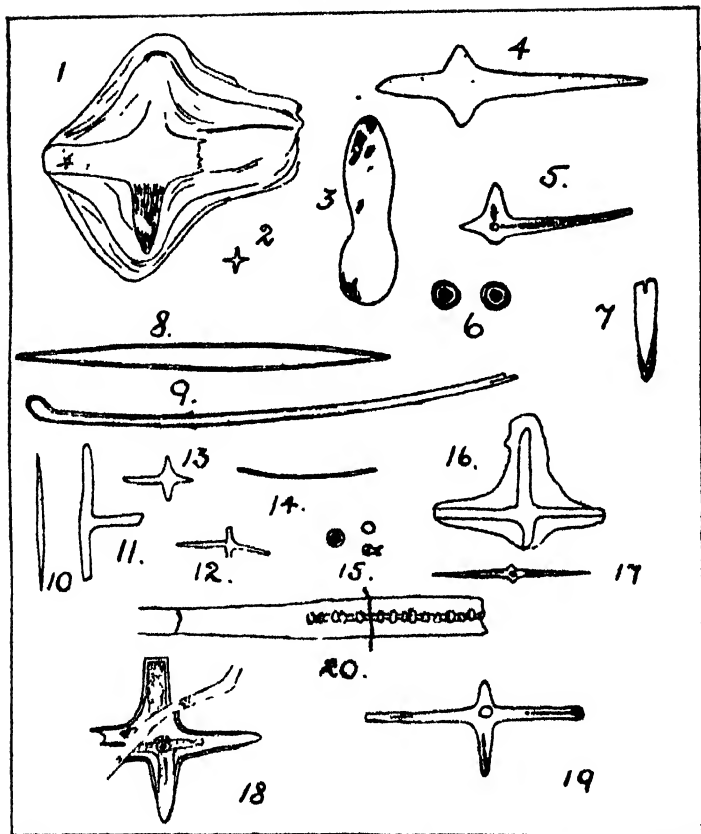
Modern *Hyalonema*, which is comparable with the fossil *Pyritonema* (which occurs in the iron-ores), has been recorded by Schültze (6) as occurring at depths ranging from 345 to 2425 fathoms. Without assuming the depth at which *Pyritonema* lived (for which there is little evidence), it is apparent that it must have enjoyed a comparatively clear area sheltered from violent currents and wave-action either by depth or by material barriers. The forms are somewhat dwarfed, which may indicate that the habitat was excessively salt, which again would point to a close association of the sponge-nursery and the area of ore-deposition and to the contemporaneity of the sponges and the ores.

Frequently mudstone beds are associated with the sponge-bearing ores, which themselves often have an argillaceous matrix. It is probable that the gentle currents required to drift the fine silt into the place where the precipitation of iron-silicate was proceeding also drifted in the spicules of *Pyritonema*, for it is unlikely that the sponges actually lived in waters with such an iron concentration as could precipitate the iron salts of the ores.

The spicules are monaxons (text-fig. 2, 8), hexactins (text-fig. 2, 1, 4, 11, 16, 18, & 19), and rare monaxon-like forms with clubbed (text-fig. 2, 9) or forked ends.

The majority of the spicules belong to the genus *Pyritonema*, the Lower Paleozoic form of *Hyalostelia* (7), and it is suggested to two species, which are diagnosed below. A slice from Llandegai shows a distinct type of spicule which apparently belongs to a monactinellid form, which is doubtfully referred to the genus *Reniera*.

Text-fig. 2.



Spicules of *Pyritonema minuta* (1, 9, 18, 20) [$\times 30$]; and
P. delicata (9-17, 19), from various localities.

1-9. Spicules of *Pyritonema minuta*.

1. Hexactine, occurring as nucleus to an oolith. Pen y Gaer. Slice-number C 58.
2. Microscletere. Hen dy Capel. Slice-number C 20.
3. Section at the node of a hexactine; in banded pyritic mudstone. Penterfyn. Slice-number S 3694*.
4. Hexactine, preserved in pyrite; Bwlch Goch, Cader Idris. Slice-number S 3693.

* The numbers S 6391-98 are those of thin slices deposited at the British Museum [Natural History].

EXPLANATION OF TEXT-FIG. 2 (continued).

5. Hexactine, showing axial canal. Coed Rhiwiau, Aber. Slice-number S 3695.
 6. Transverse sections of spicule-rays, showing axial canals. Hen dy Capel. Slice-number S 3691.
 7. Part of anchoring spicule, in spiculiferous mudstone. Pen y Gaer. Slice-number C 79.
 8. Anchoring spicule. In nodule, Coed Rhiwiau, Aber. Paratype. Slice-number S 3695.
 9. *P. minuta*? Monaxon with clubbed end, and showing traces of spiny ornament. Coed Rhiwiau. Slice-number S 3695.
- 10-17. Spicules of *Pyritionema delicata*.
10. Anchoring spicule. In nodule, Llandegai. Paratype. Slice-number S 3697.
 11. Part of hexactine. Nodule, Ystrad. Slice-number S 3696.
 12. Hexactine. Nodule, Bryn Poeth. Slice-number E 42.
 13. Hexactine. Nodule, Cross Foxes. Slice-number N 14.
 14. Anchoring spicule? Cross Foxes. Slice-number N 14.
 15. Transverse sections of spicules. Nodule, Tremadoc. Slice-number S 3692.
 16. Hexactine enclosed in chloritic growth. Tremadoc. Holotype. Slice-number S 3692.
 17. Hexactine. Nodule, Coed Rhiwiau. Slice-number S 3695.
 18. *P. minuta*. Hen y Capel, Llanengan. Slice-number S 3691. Showing axial canals. The edges and stippled portion of the spicule are preserved in a brown isotropic mineral, and the remainder in silica. The veinlet contains quartz and chlorite.
 19. *P. delicata*. Ystrad, Bettws Garmon. Showing axial canals. Slice-number S 3696.
 20. *P. minuta*. Bryn Poeth, S.E. Anglesey. Slice-number E 31. Portion of large anchoring spicule with moniliform canal. The canal is infilled by chlorite; the remainder of the spicule is preserved in silica.

All drawings magnified $\times 30$.

Phylum **PORIFERA**.Order **HEXACTINELLIDA** O. Schmidt.Genus **PYRITONEMA** M'Coy, emend. Rauff.

Simple hexactinellid spicules, usually with one axis elongated. Also spicules with one or more rays inflated, spined, or knobbed. Anchoring chain of bundles of straight or slightly curved one-rayed spicules of various size.

Pyritionema minuta, sp. n. (Pl. II. figs. 1, 2, 3 ;
text-fig. 2, 1-9, 18, 20.)

1894. *Pyritionema fasciculus* (pars), Rauff, Paleontographica, xl.
(5-6), p. 259, pl. iv. figs. 5-9.

Detached spicules only known. Monaxons of variable length to a maximum of about 6 mm. long, and diameter

0.1–0.26 mm. Generally straight, but some are smoothly curved. One example bears traces of small spines (text-fig. 2, 9). Hexactines of size comparable with the monaxons; occasionally with one or more rays considerably elongated. Rarely hexactine microscleres are present.

Holotype.—That figured in Pl. II. fig. 1; slice-number S 3696, Ystrad Mine, Bettws Garmon. Paratypes (Pl. II. fig. 2); slice-number S 3691, Hen dy Capel, Llanengan (text-fig. 1, 8; slice-number, S 3695, Coed Rhiwiau, Aber.

Horizon of holotype, top of the Maentwrog Beds; of paratype from Llanengan, zone of *N. gracilis*?; of Aber paratype, Llanvirn.

Remarks.—Only one undoubted example of the anchoring-rope has been found—in a nodule from Bettws Garmon (the holotype). This specimen is comparable with *Pyritonema* (*Hyalostelia*) *girvanense* figured by Nicholson and Etheridge (8, 1880, pl. xix. fig. 16), but *P. girvanense* is about three times as large as *P. minuta*. *P. minuta* is also smaller than *P. fasciculus* M'Coy, according to the measurements given by Hinde (9, 1887).

Rauff (7, p. 260) regards anchor spicules and hexactines of very nearly the same dimensions as *P. minuta* as belonging to *P. fasciculus* M'Coy, of which, however, no hexactine-spicules were recorded from the type-locality. Rauff's figures point to a close resemblance between *P. minuta* and the *P. "fasciculus"* from the *Leptaena*-kalk of Dalarne, Sweden.

Pyritonema has not previously been recorded from so low a horizon as that of the Bettws Garmon ore. Walcott (10, 1920) records an allied form *Kiwetinokia* from the Middle Cambrian of Utah, but it is distinguished from *Pyritonema* by the rope-like twist of its anchoring-chain and the presence of triaene spicules.

Pyritonema delicata, sp. n.
(Text-fig. 2, 10–17 & 19.)

Detached spicules similar to those of *P. minuta*, but more slender, and with the spicule-rays of more uniform thickness.

Holotype that figured in text-fig. 2, 16, in a nodule from Tremadoc, Carnarvonshire. Slice-number S 3692.

Paratype (text-fig. 2, 10); Penrhyn Mine, Llandegai, near Bangor. Slice-number S 3697.

Horizon of holotype, zone of *Nemagraptus gracilis*; of paratype, Llanvirn?

Remarks.—Spicules of *P. delicata* are not so frequent as those of *P. minuta*, with which they are often, but not always, associated. They are easily distinguished by their delicate appearance.

Order MONACTINELLIDA Zittel.

Genus RENIERA O. Schmidt.

Skeleton of small straight or slightly curved spicules of approximately uniform size, united during life by spongin and forming a mesh.

Reniera (?). (Pl. II. fig. 4.)

Spicules cylindrical, smooth, straight, or gently arcuate, with blunted terminations. Length 0.25–0.33 mm., thickness 0.02–0.03 mm. Axial canals not seen.

Holotype that figured in Pl. II. fig. 4. Slice-number S 3697. Nodule, Penrhyn Mine, Llandegai, near Bangor.

Horizon.—Arenig?

Remarks.—It is necessary to identify this form with reserve, and it is not sufficiently well known to name specifically. The form, however, is strongly reminiscent of a Monactinellid spicule, and does not resemble fragments of broken *Pyritonema*-spicules. The Monactinellid which most resembles this isolated form is *Reniera*, hence the Welsh specimen is included in that genus.

In conclusion, I wish to thank Dr. H. D. Thomas for reading the manuscript of this paper, and making a number of important suggestions: and the Department of Scientific and Industrial Research for a grant which enabled me to collect and investigate the spiculiferous iron-ores. Also I wish to thank Prof. W. G. Fearnside for permission to figure a slice from his collection, and Mr. J. Shirley, M.Sc., for pointed criticism.

REFERENCES TO LITERATURE.

- (1) See FEARNSIDES, W. G. Tremadoc paper. Q. J. G. S. 1910, vol. lxxvi. p. 170.
NICHOLAS, T. C. St. Tudwal's paper. Q. J. G. S. 1915, vol. lxxi. p. 123.

- See GREENLY, E. Geological Survey Memoir on Anglesey, vol. ii. p. 406 and p. 432 *et seq.*
 COX, A. H. Cader Idris paper. Q. J. G. S. 1925, vol. lxxxii. p. 556.
 Geological Survey Memoirs. —Special Reports on Mineral Resources: Iron Ores, vol. xiii. (1920) and vol. xxix. (1925).
 (2) CAYEUX, L. 'Les Minerais de fer oolithique de France,' vol. ii. 1922, p. 774.
 (3) ——. *Ibid.*, p. 913.
 (4) New York State Museum Bulletin, 1922, no. 239-240, plate facing p. 24.
 (5) COX, A. H. *Loc. cit.* p. 556.
 (6) 'Challenger' Reports, vol. xxi. (1887).
 (7) RAUFF, H. "Palæospongiologie." 'Paleontographica,' 1893-1894.
 (8) NICHOLSON & ETHERIDGE. 'Monograph of the Silurian Fossils of the Girvan District,' 1880, pl. xix. fig. 16.
 (9) HINDE, G. J. Paleontographical Society Memoir, 'British Fossil Sponges,' 1887, p. 110.
 (10) WALCOTT. "Middle Cambrian Spongiæ." Smithsonian Misc. Collections, 1920, vol. lxvii. no. 6, p. 311, pl. lxxxix.

EXPLANATION OF PLATE II.

- Fig. 1. Cross-section of rope-spicules of *P. minuta*, $\times 15$. Holotype. Slice-number S 3696. Bettws Garmon; top of the Maentwrog Beds.
 Fig. 2. *P. minuta*, $\times 15$. Hexactine with characteristic elongation of one ray. Paratype. Slice-number S 3691. Llanengan, zone of *N. gracilis*.
 Fig. 3. Spicule of *P. minuta* acting as nucleus to an oolith, $\times 15$. Slice-number S 3698 from Prof. W. G. Fearnside's collection. Tremadoc Iron Mine. Horizon, zone of *N. gracilis*.
 Fig. 4. Spicules of *Reniera* (?). Holotype. Slice-number S 3697. Penrhyn Mine, Llandegui, near Bangor. Llanvirn?

IX.—On a new Palæoniscid Genus from Madagascar.

By JAMES BROUGH.

[Plate III.]

I. INTRODUCTION AND TECHNIQUE.

Among the beautiful fish-remains unearthed from the Lower Triassic deposits of Madagascar in recent years were a number of specimens of a Palæoniscid fish, which were doubtfully assigned to the genus *Gyrolepis* by Priem (1924) and named by him *Gyrolepis? gillioti*. M. Priem's doubts are well founded, for although the genus *Gyrolepis* is imperfectly known, it is quite certain that it differed considerably from the Madagascar fish. There is some similarity in the ornamentation of the scales, but this

is an unreliable character and should not be used alone. When other characters are considered it is seen that differences are numerous; these will be considered on a later page.

M. Priem's account of this form is brief and scarcely extends beyond a description of the ornamentation of the scales. The object of the present paper is to make known the structure of the head, definitely to remove this form from the genus *Gyrolepis*, and to erect a new genus to receive it. For this I propose the name *Diaphorognathus*, in reference to the peculiar truncation of the lower jaw.

I owe the opportunity of carrying out this redescription to the kindness and courtesy of M. Jean Piveteau of the National Museum, Paris, and Professor D. M. S. Watson of University College, London, who provided the necessary material.

The specimens examined were two in number, and in each case the fish provided the nucleus for the formation of an ironstone nodule. These nodules appear to have been contemporaneous productions, for the fishes had not been long dead, and were not to any great extent disintegrated when entombed. The formation of an ironstone nodule round the fish at this very early stage in fossilization prevented any considerable subsequent crushing, and when the nodules are dug out and split open they are essentially hollow, containing only a little mixed bony matter and ferruginous clay. When the interior is washed out with acid a very perfect mould of the fish remains, and this is best studied by making a series of casts and so examining the fish as a solid object. The best material for this purpose is the mixture of gelatine and glycerine commonly used by palæontologists: it allows a perfect cast to be made where plasticine would fail, owing to irregularities in the mould of the head.

Although useful for study, this material usually does not photograph well, owing to the presence of surface reflections and the monochromatic nature of the substance. The first is the most serious objection, and generally prevents the taking of good photographs. In the present instance it was decided to attempt the preparation of the surfaces in the hope of obtaining photographs suitable for reproduction.

The casts were coated with a very fine powder, which effectively dulled the surface; the powder was then dusted on in such a way that the cracks and sutures held a heavier deposit than the general surface. This fine coating material was of a different colour to that of the gelatine casts and so a colour-difference was obtained. The objects were then photographed on a panchromatic plate. The material used was a cheap variety of ordinary toilet powder of a creamy tinge, and was dusted on with a powder puff.

II. DESCRIPTION.

Both specimens are only slightly crushed: the bodies are somewhat flattened, and the weaker parts of the skull have caved in. This is noticeable in the region of the jaws and at the tip of the snout. The roof of the skull is almost in its natural condition (Pl. III.), and the width of the skull at its posterior end can be ascertained fairly accurately. The orbits, are of course, vacant, but they are more or less entire, and in the casts parts of the palate and neurocranium are visible in them. In one of the specimens the slight crushing in the trunk region allows the impression of the vertebral column and the abdominal cavity to be visible.

These specimens, although wonderfully preserved as far as they go, are not quite complete. As was frequently the case in this mode of preservation, the tail was not enclosed when the nodule was formed, and so has been lost. The fins are also incomplete, again being toward the edge of the nodule, but the anterior part of the fish and the head particularly are in a state of preservation little short of perfect.

The fish was fusiform (rather deeply so) and did not possess the long lean raking lines commonly to be observed among the Palaeoniscid fishes. The head, too, was deep and blunt, and the snout was rounded. The suspensorium is only slightly oblique. The dentition is feeble, and it is clear that this was not a predacious animal and was ill-adapted for preying on other fishes.

The orbits are exceedingly large, very forwardly situated, and extend right to the front of the head. The olfactory capsules must have been very small and rather medianly situated between the anterior part

of the orbits. The gape was wide. The skull-bones and all the scales are finely ornamented.

The anal and caudal fins are not visible in my specimens. The other fins are small; the dorsal is situated above the pelvics.

Head.—The sculpturing of the external skull-bones is uniform, and consists of a series of rather fine wavy ridges which branch and anastomose.

The greater part of the skull-roof is formed by two regular pairs of bones—the frontals and parietals. The former are elongate quadrangular in shape, but are a little broader behind than in front. The parietals are comparatively large, and adjoin the posterior borders of the frontals with an undulating suture. They are more or less rectangular, but their length is very little greater than their width. Their outer posterior angles are slightly produced.

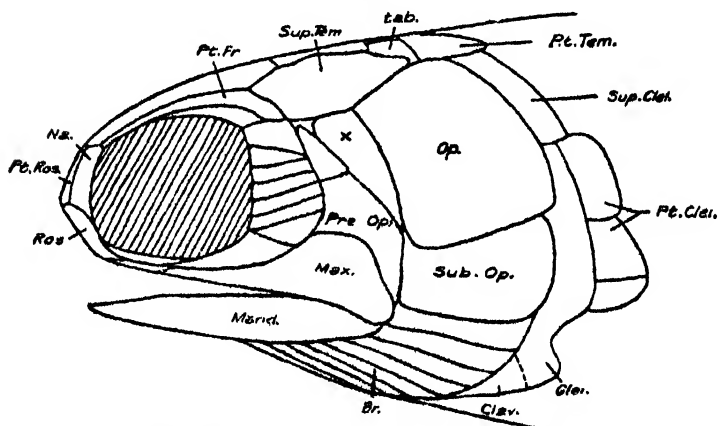
Behind the parietals there are two pairs of tabular bones. The mesial pair is the larger and each bone is bounded anteriorly by the parietal and externally by the outer tabular. The posterior border is angular, the inner part meeting the scaly covering of the body in the region of the mid-dorsal line, while the outer part of the border abuts against the post-temporal.

The outer tabulars are small, rather triangular elements which are wedged in between the inner tabular, the supratemporal, and the post-temporal.

Lateral to this median row of roof-bones there are two elements, the so-called postfrontal and posterior to it the supratemporal. The former is a curious element, and the name postfrontal is not absolutely fitting. It is rather club-shaped, being narrow anteriorly and widening out slowly at first, and then more abruptly at its posterior end. It is thus long and narrow, but is not really so narrow as it appears in the restorations, because the surface of the skull was a convex curve in that region, and neither the top nor the side view can show the full width of this bone. It extends from the extreme anterior of the frontal and runs alongside this element almost through its whole length. Anteriorly its outer margin enters freely into the border of the orbit, but posteriorly it is hedged by a supraorbital ossicle. Its posterior margin is in contact with the whole of the

anterior border of the supratemporal. Thus in its posterior parts it has exactly the relations and appearance of the bone called postfrontal in *Dicellogobius* and the *Catopterids*. Its anterior extension right forward until it makes contact with the nasal, however, can scarcely be termed a characteristic feature of the postfrontal bone. It has the relations of a prefrontal in the anterior region, and it is likely that it is a compound element. For convenience, however, it will be referred to here as "postfrontal."

Text-fig. 1.



Diaphorognathus gillioti. Lateral view of the
restored head. \times about 24.

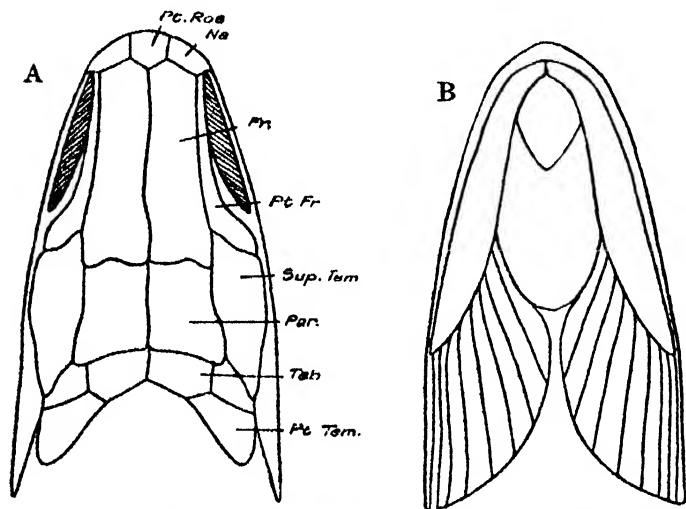
Br., branchiostegal rays; *Clav.*, clavicle; *Olei.*, cleithrum; *Mand.*, mandible; *Max.*, maxilla; *Na.*, nasal; *Op.*, operculum; *Pt.Olei.*, postcleithral scales; *Pt.Fr.*, postfrontal; *Pt.Ros.*, postrostral; *Pt.Tem.*, post-temporal; *Pre.Op.*, preoperculum; *Ros.*, rostral; *Sub.Op.*, suboperculum; *Sup.Olei.*, supracleithrum; *Sup.Tem.*, supratemporal; *Tab.*, tabular.

as deep, and tapers to a point both anteriorly and posteriorly. It lies alongside the median roof-bones, and its lower region is in contact with the operculum posteriorly and the ossicles above the preopercular anteriorly. In front of this it adjoins the posterior border of the postfrontal.

The snout is covered by five bony plates. Fitting into the angle between the two frontals there is a median

postrostral element. This is in the form of an elongated hexagon, and is bounded laterally by the nasals and inferiorly by the rostrals. The nasals are somewhat quadrangular in shape, but their outer margin is considerably longer than the inner. Their mesial margin is in contact with the postrostral, while their outer edge forms the anterior border of the orbit. Below they meet the upper margins of the rostrals. The latter is a pair of elements which meet in the middle line and adjoin the postrostral and nasals above and probably abut against a premaxilla below. The middle part of their outer border is, for a short distance, free in the orbital rim.

Text-fig. 2.



Diaphorognathus gillioti. A. Dorsal view. B. Ventral view, showing the disposition of the branchiostegal rays and gular plates. \times about $2\frac{1}{2}$.

Fr., frontal; Par., parietal. Other lettering as in text-fig. 1.

These bones are interpreted as rostrals, but only doubtfully; it is possible that they may be premaxillæ. Premaxillæ are presumed to occur behind these so-called rostrals, but they have not been actually observed. The bones called rostrals here are reminiscent in some ways of the premaxillæ of *Palæoniscus* and the Catopterid *Campylognathus*.

An important criterion for determining whether a bone is a premaxilla or not, the bearing of marginal teeth, is of little use in this case, since the general dentition is so reduced as to be almost invisible.

The cheek-region is covered by a large number of bony plates. The operculum is very large: it is deeper than wide, and its corners are angular except for the dorso-posterior one which is gently rounded. It is free behind, but is attached above to the supratemporal and in front to the bone X, which lies between it and the preoperculum. It overlaps the suboperculum ventrally: the latter is a rectangular plate with rounded corners, which is slightly wider than deep. The suboperculum articulates below with the first of a series of seven or eight branchiostegal rays. These are comparatively few, and are long and stout: the surfaces of all are ornamented like the other external bony elements of the skull.

The preoperculum is not such a very prominent element as it frequently is in the skull of Palæoniscid fishes. It is a fairly large bone, irregularly shaped, and somewhat curved. Its lower border is firmly united to the dorso-posterior margin of the maxilla. Its posterior border meets the suboperculum, and anteriorly it abuts against the postorbital ossicles. Its upper margin articulates with two bones which are at present unnamed. The most posterior and larger one is wedge-shaped with the point ventrally directed and inserted between the operculum and preoperculum. Its upper border, the base of the wedge, adjoins the supratemporal, while the upper part of its anterior margin meets another ossicle. This also is wedge-shaped, but in the other direction; its base rests on the upper margin of the preoperculum and anteriorly it meets the postorbital ossicles. It tapers to a point dorsally, and this point appears to be free. It ends in a little unoccupied space which is bounded above by the supratemporal, in front by one of the postorbitals, and behind by the long wedge-shaped bone which lies in front of the operculum. It was thought that this little space may have marked a spiracular opening, but it appears to be situated a little too far forward.

The orbit is bounded by a number of peculiarly shaped little bones of obscure homologies. There is a series

of elongated elements whose anterior margins form the posterior part of the orbital rim. These postorbital ossicles are long and regular—the median ones are of regular shape and are very narrow, but the most dorsal two and the one most ventral are rather triangular-shaped and slightly deeper than the rest.

The posterior part of the dorsal border of the orbit is bounded by a small bone which adjoins the most dorsal postorbital ossicle posteriorly, and tapers away anteriorly until it ends in a point.

The ventral rim of the orbit is lined by two ossicles, the most posterior of which is fairly large, and in an inverted way has very similar relations as the bone just described on the dorsal margin of the orbit. It rests in the upper border of the maxilla, and posteriorly adjoins the lowest postorbital ossicle. It tapers to a point anteriorly, where it is overlapped by a small and very narrow bone, which continues forwards, and finally itself tapers away against the outer side of the rostral.

The jaws are very large, but are not so massive as those of many *Palæoniscids*. The maxilla is deep behind where it is in contact with the preoperculum, but anteriorly it tapers rapidly, until below the orbit it is only a thin bridge of bone. The postero-ventral region is somewhat produced and is slightly turned down, but not to the extent which is usual in *Palæoniscid* fishes. The position of the premaxillæ is doubtful, and it may be, as is previously stated, that the bones called rostrals are, in fact, the premaxillæ.

The mandible is long, but not particularly deep. It has one great peculiarity in that the upper margin appears to be truncated anteriorly, making it very doubtful as to whether or not the fish could completely close its mouth. Traced from behind, the upper margin of the mandible is straight, and continues so for about two-thirds of its length, but when the anterior third is reached it has an appearance of having been cut away. It has a straight border, but it makes an angle with its posterior continuation. Teeth are present in both maxilla and mandible, but are difficult to detect, for, although quite numerous, they are small delicate structures.

The angle on the ventral surface between the mandibles is closed by two median gular plates placed in longi-

tudinal series. The most anterior one is small and roughly diamond-shaped, and fits into the angle behind the symphysis of the jaws. It overlaps a much larger posterior plate, which is also single and median, and which posteriorly gives way to the branchiostegal rays.

Parts of the palate and neurocranium could be discerned, but they are not sufficiently intelligible to allow a useful description to be made.

The external pores of the sensory canals are apparently too fine to be distinguished, and since no actual bone is preserved in these two nodules it is not possible to make out the course of the canals.

Appendicular Skeleton.

The external shoulder-girdle is of the usual Palæoniscid type, and consists of four pairs of elements. The post-temporal is a triangular-shaped bone which is firmly attached to the posterior part of the skull-roof, fitting into the posterior margins of the tabulars. The supracleithrum is a narrow rectangular element of regular shape. It is overlapped above by the post-temporal, and below it overlaps the upper end of the cleithrum. The latter is a large characteristically-shaped bone. It is broader below and tends to taper dorsally. The anterior border is curved, and where the bone is widest the posterior margin is strongly notched, this notch marking the position of articulation of the pectoral fin. The ventral portion of the bone projects anteriorly for a short distance, and it is overlapped by the clavicles. The clavicles were not directly observed, but there is little doubt from the relationships of the other bones that they were present. There are a number of modified scales behind the cleithrum.

All the external bones of the shoulder-girdle display an ornamentation similar to that of the skull-bones.

The pectoral fin has its base somewhat constricted. It consists of numerous, about twenty, fine rays, the more anterior of which are not articulated except near their tips.

The dorsal is a rather small triangular fin composed of about sixteen rays, which are all completely articulated.

The specimens under description yield no information as to the condition of the other fins. Priem asserts that the fins are fulcrated—a condition which is not unlikely.

Squamation.

The rhombic ganoid scales are of medium size and are regularly shaped. On the flank they are almost square, but they become very much more numerous and much shallower toward both the dorsal and ventral surfaces of the fish. For this reason it is difficult to count the number of scales in a row.

The flank-scales each bear eleven to thirteen oblique striæ, which may anastomose.

III. RELATIONSHIPS OF *DIAPHOROGNATHUS*.

After Agassiz, in 1835, described a few isolated ornamented scales as *Gyrolepis alberti*, a tendency was manifested among palæontologists to include almost any Palæoniscid fish with obliquely striated scales in this genus.

In 1877, Traquair, in a characteristically long-sighted article, began to clear the ground and proved conclusively that all the British Carboniferous forms attributed to *Gyrolepis* belonged to other Palæoniscid genera.

Dames, in 1888, produced a good account of the genuine Muschelkalk *Gyrolepis* species, and this has remained the best work on this genus up to the present day. It has not, however, completely corrected the old tendency, and, although it is now recognized that *Gyrolepis* is not a Palæozoic form, there is a suspiciously large and varied collection of Palæoniscids from the Triassic still ascribed to this genus.

Priem, confronted with this new Madagascan Palæoniscid, was again impressed by a certain similarity in the scales, and hesitatingly included it with *Gyrolepis*. The following characters of *Gyrolepis*, however, show beyond doubt the generic distinctness between it and *Diaphorognathus* :—

- (1) The suspensorium is very oblique.
- (2) The opercular bones are much narrower and much more elongated than those of *Diaphorognathus*. In fishes of the same size they are only about half the width.
- (3) The bones behind the orbit show a different configuration to those of the Madagascar genus.
- (4) The mandible is of normal shape and lacks the peculiar truncation seen in *Diaphorognathus*.

(5) The dentition is essentially different -- there being many comparatively large, sharply pointed teeth.

(6) The branchiostegal rays are small and numerous ; there are at least twice as many as in *Diaphorognathus* and there are no large gular plates.

Although their generic distinctness is unquestionable, there is some degree of resemblance between these forms, particularly in the nature of the skull-roof. It also appears from the description given by Dames that *Gyrolepis* has the same large postfrontal and supratemporal, and that their relationships are the same as in the genus here described.

The general structure of the skull of *Diaphorognathus* is, however, more comparable to that of *Palæoniscus* than to that of any other known Palæoniscid. In the latter genus the suspensorium is more oblique, and the snout is sharper and more elongated than in *Diaphorognathus*, but if the *Palæoniscus* skull were to be compressed antero-posteriorly to the proportions of *Diaphorognathus* it would bear a distinct resemblance to the latter. The bones of the snout appear to be much the same, and those of the skull-roof are not markedly different. The postorbital ossicles of *Palæoniscus* are of the same type as those of *Diaphorognathus*, but their borders are rounded, not angular.

A noticeable difference is furnished by the presence of two small bones above the preoperculum, between it and the inferior border of the supratemporal, in *Diaphorognathus* : according to Traquair's figure, these are absent in *Palæoniscus*. The place of the large post-frontal of *Diaphorognathus* is apparently taken by a number of tiny supraorbital ossicles. Again, the branchiostegal rays are more numerous than in the latter form.

The body of *Palæoniscus* is more slender than that of *Diaphorognathus*, and is covered by small, perfectly smooth, rhombic scales. These differ very obviously from the larger striated scales of the Madagascar fish, and the fins also differ ; they are comparatively much larger in the latter genus.

Bearing in mind these differences, it would be untrue to say that *Diaphorognathus* is closely related to *Palæoniscus* ; it can only be stated that it is closer to *Palæoniscus* than to any other known form.

During a recent visit to Stockholm, Prof. Stensiö very kindly showed me some fragmentary remains of a Paleoniscid fish from the Eotriassic of East Greenland; and, although it is difficult to be certain, it is probable that this form is a close ally of *Diaphorognathus*, and thus will form another link between these widely separated, but closely similar, early Triassic fish-faunas of Madagascar and East Greenland.

REFERENCES.

- AGASSIZ, L. (1835). Poiss. Foss. vol. ii. pt. 1, p. 173.
DAMES, W. (1888.) Palæont. Abhandl. vol. iv. p. 143.
PRIEM, F. (1924.) Annales de Palæont., Tome xiii. p. 107.
TRAQUAIR, R. H. (1877.) Quart. Journ. Geol. Soc. vol. xxxiii. p. 548.

EXPLANATION OF PLATE III.

Diaphorognathus gillioti.

Figs. 1 & 2. Lateral view of the two specimens described. About natural size.

Fig. 3. Dorsal view of the head.

Fig. 4. Lateral view of the head and anterior body-region. .

Figs. 3 and 4 enlarged nearly $2\frac{1}{2}$ times.

X.—*A Collecting-trip in Switzerland.*

By MARTIN E. MOSELY, F.E.S.

IN the summer of 1927, I was ordered to Switzerland for reasons of health, and spent three months, mainly in the Upper Engadine, collecting Trichoptera, Plecoptera, and Neuroptera. During the whole of my stay I was in close touch with the late Dr. Ris, to whom I sent, almost day by day, the records of my collecting for publication in some Swiss journal. Dr. Ris was, at the time, busily engaged on his Odonata work and these records have never been published. Unfortunately, on his death, my notes could not be found amongst his papers, so that, for the purposes of this article, it has been necessary to attempt their reconstruction by means of a search through my cabinets and those in the Natural History Museum, where many of my duplicates were deposited. Whilst all the species that I captured are duly recorded here, it is probable that some of the localities in which they occur have been omitted, as in

many cases I contented myself with noting the presence of a species already in the collection, without actually retaining it. It is therefore to be regretted that this record is not so complete as that which has been lost.

When the determinations had been made and the localities noted for Dr. Ris, the material from Pontresina and its neighbourhood was grouped under the comprehensive label "Upper Engadine." This more particularly applies to the Trichoptera and the label covers the Pontresina valley from Celerina up to the top of the Bernina pass with its three lakes (Piccolo, Nero, and Bianco); the main Samaden valley, with its chain of lakes, from Maloja, where I spent a week, down to Zernetz, one of the gateways to the Swiss National Park and the beginning of the Lower Engadine. Separate labels were printed for Poschiavo (a town far down the Bernina pass towards the Italian frontier), for the Val Bregaglia (which is a pass from the Maloja into Italy), and for the Julier pass.

In certain cases where microscope-preparations were made, exact localities in this district were noted and these appear in my lists.

The tour began on the 16th April, 1927, with a week spent at Lucerne, which was my headquarters for excursions round the lake, to Engelberg and to the smaller lakes Baldegg and Sarnen in the vicinity. Here the capture of *Synagapetus iridipennis* was of interest, as the species was found at one small stream just outside Lucerne and nowhere else during my stay in Switzerland.

From Lucerne I made my way to Pontresina, staying a day and a night at Andermatt, where I found *Drusus alpinus* in abundance, as well as other species of lesser interest.

Pontresina, my chief headquarters and where over six weeks were spent, was a good centre, but in itself disappointing as a collecting-ground. In the narrow wooded valley the streams are mainly too cold, though in many of them I found larval forms of autumnal species. It was very cold on my arrival and a heavy fall of snow put an entire end to collecting for a couple of days while it melted. Here and there, high up the mountains, there were sunny slopes where captures of interest were made. *Drusus nigrescens* was plentiful

at all springs in such localities, as also was the stone-fly *Dictyogenus fontium*.

With suitable localities so restricted, my attention was mainly directed to the wider Samaden valley, and the week at Maloja, in particular, was of great interest and contributed largely to the collection. There, and only there, I found that interesting little Trichopteron *Lithax niger*, considered to be a purely alpine species until Lestage recorded it in Belgium.

A week was put in, at Dr. Ris's suggestion, at Cierfs, in the Münsterthal, and results amply repaid the visit. One visit was made into Italy over the Bernina pass, and at Sondrio I collected a few species, of which *Diplectrona atra* may perhaps be considered worthy of mention. For convenience, the Sondrio records are included in my lists.

From Pontresina I moved on to Klosters and found there an ideal collecting-ground. The wide valley known as the Prätigan with its well-warmed streams, the passes leading over into Davos, the Vereina, the Silvretta and even the Fluelen passes were all within reach and were visited many times, and perhaps the eighteen days spent there were the most profitable of any during my three months in Switzerland. Of Trichoptera it will suffice to mention *Halesus mendax*, *Halesus ruficollis*, *Limnophilus germanus*, all abundant; and of the Plecoptera, *Leuctra* species were varied, and my collection was instrumental in the clearing up of more than one puzzle in this group.

After leaving Klosters, I descended the valley to Coire, whence I travelled by the narrow-gauge railway to Arosa, and the first week in September was spent at an altitude of 6000 ft. Cold weather was now setting in and all the hotels were on the verge of closing down till the winter.

Collecting not being very productive, I descended again to the plains, and a week spent on the shores of Lake Zurich, at Rapperswil, was full of interest. Here I discovered one species new to science, subsequently described as *Æcetis albescens*, and another, *Phacopteryx brevipennis*, new to the Swiss fauna, and was furthermore pleased to see that beautiful little Trichopteron *Mystacides monochroa* flying round the borders of the lake in comparative abundance. *Cyrnus crenaticornis* was also plentiful, and the Hydroptilidæ were well represented.

At Rapperswil I had the pleasure of meeting Dr. Ris who came over from Rheinau to join me, and I subsequently paid him a return visit on my way home and had the much-valued opportunity of examining his fine collections.

It should be mentioned, in conclusion, that many of the species represented in the lists were taken at considerably higher altitudes than are indicated by the locality. Many stiff climbs were undertaken, particularly at Pontresina, Cierfs, and Klosters.

The following places were visited during the periods indicated :—

Lucerne, 1440 ft., 16–24. vi. 1927.

Lake Baldegg, 1200 ft., 20. vi. 1927.

Engelberg, 3281 ft., 21. vi. 1927.

Lake Sarnen, 1440 ft., 24. vi. 1927.

Andermatt, 4760 ft., 25. vi. 1927.

Upper Engadine :—

Pontresina, 5916 ft., 26. vi.–11. viii. 1927.

St. Moritz, 6000 ft., various dates between 26. vi.–11. viii. 1927.

Poschiavo, 3325 ft., 1. viii. 1927.

Zuoz, 5560 ft., 3. vii. 1927.

Zernetz, 4836 ft., 5. vii. 1927.

Silvaplana, 5958 ft., 7. vii. 1927.

Maloja, 5960 ft., 10–18. vii. 1927.

Julier Pass, 7504 ft., 13. vii. 1927.

Val Bregaglia, 3950 ft., 12. vii. 1927.

Sondrio (Italy) 980 ft., 25. vii. 1927.

Cierfs, 5578 ft., 30. vii.–7. viii. 1927.

Klosters, 3960 ft., 12–30. viii. 1927.

Arosa, 6000 ft., 1–7. ix. 1927.

Lake Zurich, Rapperswil, 1430 ft., 7–15. ix. 1927.

RECORD OF THE TRIP.

TRICHOPTERA.

Fam. Phryganeidæ.

Neuronia ruficrus Scop. Pontresina ; Maloja ; Klosters.

Phryganea grandis L. Sarnen.

— *striata* L. Lucerne ; Pontresina ; Cierfs ; Klosters.

- Phryganea varia* F. Sarnen ; Rapperswil.
 ——— *obsoleta* Hagen. Pontresina ; Cierfs.
Agrypnia picta Kol. Cierfs.
 ——— *pagetana* Curt. Rapperswil.

Fam. Limnophilidæ.

- Grammotaulius atomarius* F. Rapperswil.
Limnophilus rhombicus L. Pontresina ; Maloja ; Cierfs ;
 Klosters ; Arosa ; Rapperswil.
 ——— *borealis* Zett. Cierfs.
 ——— *flavicornis* F. Rapperswil.
 ——— *decipiens* Kol. Rapperswil.
 ——— *marmoratus* Curt. Rapperswil.
 ——— *stigma* Curt. Cierfs ; Klosters ; Arosa.
 ——— *lunatus* Curt. Rapperswil.
 ——— *germanus* McL. Klosters ; Arosa ; Rapperswil.
 ——— *ignavus* McL. Cierfs ; Klosters.
 ——— *centralis*, Curt. Andermatt.
 ——— *bipunctatus* Curt. Cierfs ; Arosa.
 ——— *despectus* Walker. Pontresina ; St. Moritz.
 ——— *extricatus* McL. Pontresina ; Cierfs ; Klosters.
 ——— *sparsus* Curt. Pontresina ; Cierfs ; Klosters.
Phacopteryx brevipennis Curt. Rapperswil.
Asynarchus cænosus Curt. Upper Engadine ; Cierfs ;
 Klosters ; Arosa.
Stenophylax alpestris Kol. Pontresina ; Maloja.
 ——— *latipennis* Curt. Upper Engadine ; Cierfs ; Klosters.
Halesus interpunctatus Zett. Arosa.
 ——— *ruficollis* Pict. Upper Engadine ; Cierfs ; Klosters ;
 Arosa.
 ——— *mendax* McL. Klosters ; Arosa.
 ——— *auricollis* Pict. Klosters ; Arosa.
Anisogamus difformis McL. Silvaplana.
Metancea flavipennis Pict. Upper Engadine ; Zuoz ;
 Poschiavo ; Cierfs ; Klosters ; Arosa.
 ——— *chapmani* Morton. Poschiavo ; Klosters.
Drusus discolor Ramb. Upper Engadine ; Poschiavo ;
 Cierfs ; Klosters ; Arosa.
 ——— *chrysotus* Ramb. Upper Engadine ; Cierfs ; Klosters.
 ——— *trifidus* McL. Upper Engadine ; Silvaplana ; Cierfs ;
 Klosters.
 ——— *alpinus* Meyer-Dür. Andermatt.

Drusus monticola McL. Julier Pass.

—— *nigrescens* Meyer-Dür. Andermatt ; Upper Engadine.

—— *melanchætes* McL. Pontresina ; Julier Pass.

Cryptothryx nebulicola McL. Upper Engadine ; Poschiavo ; Klosters ; Arosa.

Potamorites biguttatus Pict. Andermatt ; Upper Engadine ; Cierfs ; Klosters.

Hypnotranus picicornis Pict. Andermatt ; Upper Engadine ; Cierfs.

Apatania muliebris McL. Val Bregaglia ; Cierfs.

Fam. Sericostomatidæ.

Sericostoma pedemontanum McL. Upper Engadine ; Val Bregaglia ; Sondrio ; Cierfs ; Klosters.

Goëra pilosa F. Lucerne ; Rapperswil.

Lithax niger Hagen. Maloja.

Silo nigricornis Pict. Lucerne ; St. Moritz ; Klosters.

Oligoplectrum maculatum Fourc. Lucerne.

Micrasema tristellum McL. Poschiavo ; Cierfs ; Klosters.

Cruncæcia irrorata Curt. Lucerne ; Klosters.

Lepidostoma hirtum F. Rapperswil.

Fam. Beræidæ.

Beræa pullata Curt. Andermatt ; Upper Engadine ; Cierfs.

—— *maurus* Curt. Sarnen.

Ernodes articularis Pict. Lucerne ; Sarnen.

—— *vicina* McL. Lucerne.

Fam. Molannidæ.

Molanna angustata Curt. Lucerne ; Baldegg ; Rapperswil.

Fam. Leptoceridæ.

Leptocerus fulvus Ramb. Rapperswil.

—— *aterrimus* Steph. Baldegg ; Sarnen.

—— *cinereus* Curt. Lucerne ; Baldegg ; Rapperswil.

Mystacides azurea L. Lucerne ; Baldegg ; Klosters ; Rapperswil.

—— *longicornis* L. Baldegg ; Rapperswil.

—— *monochroa* McL. Rapperswil.

Erotesis baltica McL. Rapperswil.

- Æcetis ochracea* Curt. Rapperswil.
 — *albescens* Mosely. Rapperswil.
 — *lacustris* Pict. Rapperswil.
 — *testacea* Curt. Baldegg ; Sarnen.
Setodes argentipunctella McL. Rapperswil.

Fam. **Odontoceridæ.**

- Odontocerum albicorne* Scop. Lucerne ; Upper Engadine ;
 Klosters ; Rapperswil.

Fam. **Hydropsychidæ.**

- Hydropsyche pellucidula* Curt. Lucerne ; Rapperswil.
 — *saxonica* McL. Rapperswil.
 — *fulvipes* Curt. Lucerne.
 — *angustipennis* Curt. Rapperswil.
Dipterona atra McL. Val Bregaglia ; Sondrio.

Fam. **Polycentropidæ.**

- Neureclipsis bimaculata* L. Lucerne ; Rapperswil.
Plectrocnemia conspersa Curt. Upper Engadine ; Cierfs ;
 Rapperswil.
 — *geniculata* McL. Silvaplana.
 — *brevis* McL. Val Bregaglia ; Cierfs ; Klosters.
Polycentropus flavomaculatus Pict. Lucerne ; Upper
 Engadine ; Sondrio ; Klosters ; Rapperswil.
Holocentropus dubius Ramb. Upper Engadine.
Cyrnus trimaculatus Curt. Lucerne ; Baldegg ; Sarnen ;
 Rapperswil.
 — *crenaticornis* Kol. Rapperswil.
Ecnomus tenellus Ramb. Baldegg ; Rapperswil.

Fam. **Psychomyidæ.**

- Tinodes wæneri* L. Lucerne ; Baldegg ; Klosters ;
 Rapperswil.
 — *rostocki* McL. Lucerne ; Rapperswil.
 — *dives* Pict. Poschiavo ; Klosters.
Lype phæopa Steph. Lucerne.
Psychomyia pusilla F. Lucerne ; Rapperswil.

Fam. **Philopotamidæ.**

- Philopotamus ludificatus* McL. Engelberg ; Andermatt ;
 Upper Engadine ; Poschiavo ; Klosters.

- Philopotamus variegatus* Scop. Lucerne; Sarnen; Klosters.
Dolophilus copiosus McL. Lucerne; Poschiavo; Val
 Bregaglia; Cierfs; Klosters.
Wormaldia occipitalis Pict. Lucerne; Sarnen; Upper
 Engadine; Poschiavo; Klosters; Rapperswil.
 — *triangulifera* McL. Val Bregaglia.

Fam. Rhyacophilidae.

- Rhyacophila torrentium* Pict. Upper Engadine; Zuoz;
 Cierfs; Klosters.
 — *obtusidens* McL. Lucerne; Upper Engadine;
 Klosters; Rapperswil.
 — *septentrionis* McL. Lucerne.
 — *aurata* Brauer. Upper Engadine.
 — *proxima* McL. Upper Engadine; Val Bregaglia;
 Cierfs; Klosters; Arosa.
 — *vulgaris* Pict. Lucerne; Sarnen; Engelberg; Upper
 Engadine; Poschiavo; Cierfs; Klosters; Arosa;
 Rapperswil.
 — *tristis* Pict. Lucerne; Sarnen; Andermatt; Upper
 Engadine; Poschiavo; Val Bregaglia; Cierfs.
 — *pubescens* Pict. Lucerne; Sarnen; Klosters;
 Rapperswil.
 — *glareosa* McL. Upper Engadine; Cierfs; Klosters;
 Arosa.
 — *stigmatica* Kol. Upper Engadine; Cierfs; Klosters;
 Arosa.
 — *hirticornis* McL. Lucerne.
Glossosoma boltoni Curt. Klosters; Cierfs; Arosa.
Agapetus fuscipes Curt. Upper Engadine; Sondrio.
Synagapetus iridipennis McL. Lucerne.

Fam. Hydroptilidae.

- Ptilocolepus granulatus* Pict. Lucerne; Andermatt;
 Cierfs.
Agraylea multipunctata Curt. Rapperswil.
 — *pallidula* McL. Rapperswil.
Hydroptila femoralis Eaton. Lucerne.
 — *occulta* Eaton. Lucerne; Sondrio.
Orthotrichia tetensi Klap. Rapperswil.
Oxyethira costalis Curt. Lucerne; Rapperswil.

PLECOPTERA.

- Dictyogenus alpinus* Pict. Upper Engadine ; Cierfs ; Arosa.
 — *gelidus* Klap. Upper Engadine ; Cierfs.
 — *fontium* Ris. Upper Engadine ; Cierfs ; Klosters.
Perlodes intricata Pict. Upper Engadine ; Klosters ; Arosa.
 — *macrura* Klap. Cierfs.
Rhabdiopteryx neglecta Alb. Andermatt ; Pontresina ; Upper Engadine.
Capnia conica Klap. Upper Engadine.
Leuctra cylindrica De Geer. Cierfs ; Klosters ; Arosa.
 — *moselyi* Morton. Cierfs ; Klosters.
 — *braueri* Kempny. Klosters.
 — *rosinae* Kempny. Cierfs.
 — *armata* Kempny. Upper Engadine ; Zernetz ; Cierfs.
 — *cingulata* Kempny. Upper Engadine ; Maloja ; Klosters ; Arosa.
 — *cincta* Morton. Klosters.
 — *inermis* Kempny. Lucerne ; Andermatt ; Maloja ; Cierfs ; Klosters.
 — *teriolensis* Kempny. Upper Engadine ; Maloja ; Cierfs.
 — *carinthiaca* Kempny. Klosters ; Arosa.
 — *albida* Kempny. Lucerne ; Andermatt ; Klosters.
Protonemoura fumosa Ris. Klosters.
 — *nimborella* Mosely. Klosters.
 — *nitida* Pict. Klosters.
 — *lateralis* Gerst. Lucerne ; Andermatt ; Maloja ; Arosa.
 — *brevistyla* Ris. Upper Engadine ; Cierfs ; Arosa.
Nemoura sinuata Ris. Andermatt ; Upper Engadine ; Maloja ; Cierfs ; Klosters.
 — *marginata* Pict. Lucerne.
 — *obtusa* Ris. Upper Engadine ; Maloja ; Cierfs ; Klosters.
 — *variegata* Oliv. Maloja ; Cierfs.
Nemourella inconspicua Pict. Upper Engadine ; Cierfs.
Amphinemoura cinerea Morton. Klosters.

Species of *Chloroperla* and *Isopteryx* were also taken, but have not been determined with certainty.

NEUROPTERA.

Fam. Sisyridæ.

Sisyra fuscata F. Rapperswil.

Fam. Hemerobidæ.

Megalomus tortricoides Ramb. Lucerne.

Wesmaelius quadrifasciatus Reut. Upper Engadine ;
Poschiavo ; Cierfs.

Boriomyia mortoni McL. Upper Engadine ; Poschiavo.

Hemerobius atrifrons McL. Upper Engadine.

— *pini* Steph. Andermatt ; Upper Engadine.

— *stigma* Steph. Klosters ; Arosa.

— *nitidulus* F. Upper Engadine.

— *micans* Ol. Lucerne ; Klosters.

— *humulinus* L. Lucerne ; Klosters.

— *marginatus* Steph. Lucerne ; Klosters.

Fam. Chrysopidæ.

Chrysopa flava Scop. Lucerne.

— *vittata* Wesm. Klosters.

— *carnea* Steph. (*vulgaris* Schn.). Andermatt ; Klosters.

— *ventralis* Curt. Poschiavo.

XI.—*Miocene Primates from British East Africa*. By
A. TINDELL HOPWOOD, M.Sc., F.L.S., Department of
Geology, British Museum (Natural History).

THE following diagnoses are based on specimens obtained from Koru, Kenya Colony. The deposits contain *Dinotherium hobleyi* Andrews, and hence appear to be of the same age as those in the neighbourhood of Karungu, that is to say, Lower Miocene (*cf.* Andrews, 1914, Quart. Journ. Geol. Soc. pp. 163–186).

The specimens were collected at different times by Dr. H. L. Gordon, formerly Government Medical Officer at Koru, Mr. E. J. Wayland, Director of the Geological Survey of Uganda, and by me. Full descriptions, with illustrations, will be published in the 'Journal of Anatomy,' but preliminary diagnoses are given at the

request of several other workers on the evolutionary history of the Primates.

LIMNOPITHECUS, gen. nov.

Diagnosis.—A gibbon-like Primate with very low-crowned cheek-teeth in the lower jaw. Lower molars with distinct external cingulum between the cusps; length-breadth index exceeding 90 per cent.

Genotype.—*Limnopithecus legetet*, sp. n.

Limnopithecus legetet, sp. n.

Diagnosis.—As for the genus.

Holotype.—A fragment of the right mandibular ramus with the first and second molars partly worn. Regd. M. 14079, Brit. Mus. Geol. Dept.

Paratype.—A piece of the left mandibular ramus with the two deciduous cheek-teeth, and with the lateral incisor *in alveolo*. Regd. M. 14080, Brit. Mus. Geol. Dept.

Dimensions.—

	Dm 3.	Dm 4.	M 1.	M 2.
Length	4.5	5	5.3	6.2 est.
Breadth	3.4	4.2	4.9	6.0
Height	2.8	2.1	2.8	2.8
Index	75.6	84	92.5	96.8 est.

XENOPITHECUS, gen. nov.

Diagnosis.—An Anthropoid ape in which the protocone is connected to the paracone, metacone, and hypocone by ridges; a fourth ridge connects the paracone and metacone. Cusps of trigon crowded, subequal. Hypocone large, but somewhat less than the cusps of the trigon. Anterior and posterior cingula distinct; internal cingulum massive. Enamel on lingual surface of protocones wrinkled; elsewhere it is smooth.

Genotype.—*Xenopithecus koruensis*, sp. n.

Xenopithecus koruensis, sp. n.

Diagnosis.—As for the genus.

Holotype.—A fragment of the left maxilla with the partly worn first and second molars. Regd. M. 14081, Brit. Mus. Geol. Dept.

Paratype.—A right upper posterior deciduous molar.
Regd. M. 14082, Brit. Mus. Geol. Dept.

Dimensions.—

	Dp4.	M1.	M2.
Length	5.7	6.8	7.4
Breadth	6.6	8.3	9.4
Height	3.4	2.5	3.1
Index	115.8	122.1	127

PROCONSUL, gen. nov.

Diagnosis.—An Anthropoid ape approximating to the chimpanzee in size. Premolars bicuspid; protocone from 130 to 160 per cent. the height of the deutocone; posterior cingulum prominent. First and second molars quadrate; trigon very distinct; proto-, para-, and meta-cones of about the same size; hypocone equal to the protocone, or slightly larger. Third molar reduced, subcircular; protocone larger than the paracone; metacone and hypocone very much reduced. Internal cingulum of molar teeth strong; external cingulum weak. Enamel wrinkles increase in strength from the first to the third molar.

Genotype.—*Proconsul africanus*, sp. n.

Proconsul africanus, sp. n.

Diagnosis.—As for the genus.

Holotype.—A left maxilla with the teeth from C to M3 slightly worn. Regd. M. 14084, Brit. Mus. Geol. Dept.

Dimensions.—

	C.	P3.	P4.	M1.	M2.	M3.
Length	11.3	7.3	5.8	7.0	9.2	7.8
Breadth ...	9.1	9.4	8.0	9.6	11.3	10.2
Height	15	8.1	6.4	5.2	5.4	4.9
Index	81	129	152	122	123	130

The affinities of the three genera appear to be as follows :—

Limnopithecus is a specialized descendant of *Propliopithecus* with no closer connection to the present gibbons.

Xenopithecus is a specialized Anthropoid of unknown stock.

Proconsul is related to *Dryopithecus* and ancestral to the chimpanzee.

XII.—*Papers on Oriental Carabidæ*.—XXVII.

By H. E. ANDREWES.

IN this paper there appear a few notes resulting from a recent visit to the Natural History Museum in Paris, and I have added the descriptions of a few Eastern species which for various reasons it seems desirable to publish now. A "key" is also given for discriminating the various species of *Dicælidus*, a genus which appears to be confined to South-East Asia.

Omophron stictus, sp. n.

Length 4.75–5.5 mm.

Testaceous, shiny; sterna and base of venter piceous, a transverse patch along base on the prothorax, produced narrowly at middle to apex, but not nearly reaching sides, and an elytral pattern dark green. The pattern is roughly a triangle, the base and apex corresponding with those of the elytra, the sides sending out two long rounded arms, the front one a little, the hind one much more oblique, both directed backwards and both reaching stria 13, more rarely 15; the three testaceous arms, extending inwards from sides, reach striae 7, 6, and 2 respectively, and there is generally a small pale spot on interval 5 at about two-thirds, the green colour barely reaching apex as a very sharp point.

Head smooth on disk, coarsely punctate at sides, clypeus bisetose, bordered, suture angulate at middle, mentum with the lobes rounded at sides, and sharp at apex, subocular ridges carinate, reaching buccal fissure, the surface between them and eyes coarsely punctate, joint 1 of antennæ unisetose. *Prothorax* punctate, but not very closely, a little more closely and coarsely along base, which is slightly depressed, and a little bisinuate on each side, sides straight, with a narrow reflexed border, front angles produced, long and sharp, hind angles sharp and projecting a little laterally, median line fine, very short. *Elytra* subovate, convex, base unbordered, moderately widened just behind shoulder; 15-punctate-striate, the punctures very clear, the striae behaving very irregularly towards apex, but 3–4 and 6–7 generally join and disappear early,

while 1-2 and 14-15 reach or nearly reach apex, intervals smooth and convex. No appreciable microsculpture. Sterna and first ventral segment coarsely punctate, metepisterna as long as wide, ventral segment 5 bisetose; metacoxæ bisetose.

In *O. saigonensis* Chaud. the green colour on the elytra is much lighter and the pale part almost golden, while the pattern is different. I know of no Indian species which is much like it.

TONKIN: Hoa-Binh (*A. de Cooman*). LAOS: Hat Tiang (*R. Vitalis de Salvaza*). My collection, coll. Bänninger, coll. Fleutiaux, and the Deutsch. Ent. Mus.

Bembidion beezoni, sp. n.

Length 4 mm.

Cupreous; underside, antennæ, and legs black, with metallic reflections.

Head with rather shallow parallel furrows, extending on to clypeus, eyes only moderately prominent, genæ very short, antennæ short, submoniliform, surface coarsely striate-punctate at sides and behind, vertex finely rugose-punctate. *Prothorax* convex, nearly a fourth wider than head, more than a half wider than long, base a little wider than apex, sides strongly rounded in front and slightly sinuate close to the hind angles, which are sharp, though a little obtuse, without carina; median line fine, transverse impressions slight, basal foveæ deep, surface fairly closely rugose-punctate, more sparsely on disk, where it is also transversely striate. *Elytra* moderately convex, very little dilated behind, not quite a half wider than prothorax, exactly a half longer than wide, shoulders square, the border rounding the shoulder and ending in a slight tooth above stria 5; lightly punctate-striate, the striae shallower toward apex, 8 deep behind, joining the marginal channel behind shoulder, 7 hardly shallower than the other striae, joining the deep apical stria behind; intervals nearly flat, 3 with two pores on the interval, though near stria 3, and surrounded (especially the front one) by a depressed area, covering two intervals (on the right elytron this area is much larger, on the left one the hind pore is missing), 8 subcostate along the outer side of the apical stria. Microsculpture isodiametric and distinct

throughout. *Episterna* impunctate; metasternal process bordered.

Allied to the palæarctic *B. bipunctatum* L., but smaller, without carina in the hind angles of the prothorax, the microsculpture of the elytra much more distinct.

KASHMIR: Gulmarg, Khillennurg, 11,000 feet, 28. v. 1928 (*C. F. C. Beeson*). The type is in the British Museum.

Chlœnius cookei, sp. n.

Length 10–11 mm.

Black beneath, dark green above: palpi, joints 1–3 of antennæ (rest fuscous), and legs ferruginous; elytra with the apical half of the marginal channel, and a small, oblique, narrow spot on each side, reaching apex and extending farthest forward on intervals 5, 7, and 8, flavous. Body covered with a short, fairly dense pubescence.

Head very small, frontal foveæ small but fairly deep, surface striate near eyes, with small scattered punctures elsewhere, clypeus and middle of vertex impunctate, neck very finely rugose-punctate, eyes large and prominent, labrum truncate, palpi slender, joints 3 and 4 of antennæ of equal length. *Prothorax* convex, sub-orbicular, but rather more contracted in front than behind, so that base is wider than apex, nearly a half wider than head, a third wider than long, widest at middle, sides well rounded, but straight close to the hind angles, which are a little obtuse and slightly rounded; median line faint behind, a little deeper in front, basal foveæ rather large and fairly deep, diverging slightly in front, surface very finely and closely punctate, even more closely on basal area than elsewhere. *Elytra* moderately convex, ovate, a half wider than prothorax and as much longer than wide, border rounded at shoulder; striæ moderately impressed and finely punctate. Scutellary striae fairly long, intervals nearly flat, surface finely and densely punctate. Microsculpture very faint, isodiametric on elytra and head, the meshes on the prothorax moderately wide. Underside finely punctate and pubescent, prosternal process very finely bordered, metepisterna a half longer than wide, not outwardly sulcate, profemora ♂ not dentate, tarsal joints pubescent.

In the neighbourhood of *submarginatus* Chaud. and *impressicollis* Chaud., though not much like either of them, smaller, much more finely and densely punctate, especially the head and prothorax, and with an apical spot on the elytra unlike that of any other Eastern species.

NEW DELHI (C. R. Cooke), 2 ex., ♂ ♀. The type is in my collection.

Pseudognathaphanus dekkanus, sp. n.

Length 11–15 mm.

Black: palpi and joint 1 of antennæ dark ferruginous, tarsi piceous.

Head with small but rather deep frontal foveæ, continued on each side by a fine line to the eye, labrum and clypeus both emarginate, eyes fairly prominent, mentum without tooth, antennæ slender, hardly reaching beyond base of elytra. *Prothorax* subquadrate, very convex in front, where the sides are strongly declivous, about a third wider than head and a fourth wider than long, widest at a third from apex, where a pore and seta are present, sides gently rounded, but more contracted in front than behind, so that the base, which is bordered, is a little wider than the apex, a slight sinuation quite close to the hind angles, which are right and sharp; all the normal impressions are present, but slightly developed, the basal foveæ sub-linear and converging a little forwards, surface fairly smooth, the basal area, especially at sides, microscopically punctulate. *Elytra* convex, subovate, a fourth wider than prothorax and rather more than a half longer than wide, shoulders with a small but sharp tooth, apex somewhat pointed, with a slight emargination on each side; striæ fairly deep, impunctate, 2 and the short scutellary stria arising in a small umbilicate pore; intervals moderately convex, no dorsal pores, but two or three are present on interval 7 near apex, and intervals 8 and 9 are sparsely microscopically punctulate, more closely near apex. Microsculpture isodiametric, fairly distinct on the elytra, barely visible elsewhere. Prosternal process pubescent; metasternal process finely bordered, the metepisterna impunctate, a half longer than wide; venter glabrous, apical segment with one marginal seta on each side in the ♂, two in

the ♀, joint 5 of the tarsi with setæ beneath. *Ædeagus* long, parallel-sided, and slightly curved, the dorsal aperture occupying two-fifths of the length and extending to apex, which is bluntly pointed.

The species must be placed at the end of my "key" (Ann. Soc. Ent. Belg. 1920, p. 106), being distinguished by the basal angles of the prothorax, usually obtuse and often rounded, but here sharply rectangular, and by the presence of pores at the apex of interval 7 only.

BOMBAY: Parleh, on the Western Ghats (*H. E. Andrewes*); North Kanara (*T. R. D. Bell*), and Talewadi, near Castle Rock (*S. W. Kemp*—Ind. Mus.); Khandala; Kasara (*Pusa coll.*); Satara (*F. H. Gravely*) and Panchgani (both Ind. Mus.). Type in my collection. The species was very common at Parleh when I was collecting there in 1886.

It may be noted with regard to the ♂ protarsal vesture that in *punctilabris* Macl. it is present on all the first four joints; in *levisstriatus* Sturm. joint 1 has only a small pad at the extremity of the joint; in *rusticus* m. and *dekkanus* m., and in the first joint of the mesotarsi in all these species, it is replaced by a long tuft of hairs. On the other hand, in the species of *Gnathaphanus*, sens. strict.—namely, *vulneripennis* Macl., *philippensis* Chev., *impressipennis* Cast., and *subolivaceus* Macl.,—all the first four joints in the ♂ have the normal vesture.

I adopted Dr. Schauburger's new generic name because I think it will be of assistance in the classification of the extensive Anisodactylina group, and where, as in *impressipennis* and *subolivaceus*, the tooth of the mentum is rudimentary, the form of the ♂ mesotarsi will provide a second character, but I must protest against generic names with six syllables, and specific names too; it is sufficiently troublesome to have to write them at all, but to write them on labels is next to impossible.

Crasodactylus indicus, sp. n.

Length 10–11.5 mm.

Black: palpi and joint 1 of antennæ dark ferruginous, tarsi piceous; body sparsely pubescent, rather more densely beneath and towards apex of elytra.

Head large, frontal foveæ short but fairly deep, curving round sharply towards eyes, labrum slightly emarginate, clypeus bordered, both it and front coarsely punctate, vertex nearly impunctate, eyes moderately prominent, antennæ short, mentum with a short tooth, bearing two long setæ at its base. *Prothorax* convex, suborbicular, not quite a half wider than head and as much wider than long, base bordered throughout, apex at sides only, hind angles rounded away, but the base is truncate at middle; all the normal impressions very faint, surface sparsely punctate, a little more closely along base. *Elytra* convex, shoulders square, sharply rounded, and a little emarginate on each side at apex, a fourth wider than prothorax, three-fifths longer than wide, slightly dilated behind and widest a little behind middle; striæ moderately impressed and finely punctate, scutellary striae rather long, intervals moderately convex, odd ones with an irregular row of comparatively few and small punctures, which are placed along the outer side of the interval on 1, along the inner side on the others, the apical fourth in the case of the inner intervals, the third in the case of the outer ones, and the whole of 9 densely punctate. The microsculpture of the elytra is a faint reticulation, of which the meshes are a little wider than long. Underside finely punctate; last ventral segment with two marginal setæ in both sexes.

Compared with *C. punctatus*, of which the area of distribution comprises the sandy tract extending from Algeria to the North-West Frontier Province, the prothorax is even more orbicular, the elytral intervals have one row of punctures only instead of two, and there is on the elytra an evident if faint microsculpture.

BOMBAY: Belgaum district, Belgaum and Parleh (*H. E. Andrewes*), Tavargatti (*B. M. Bhatia*, Forest Res. Inst.); Dharwar (*H. Swale*). REWA STATE: Harra (*H. S. Pruthi*, Ind. Mus.). MYSORE: Kaddur district, jungle between Kemmangundi and Kalhattigiri, 4500-6155 feet, Bababudan Hills (*H. S. Rao*, Ind. Mus.). The type is in my collection.

PANAGRUS, gen. nov.

Body winged, upper surface densely punctate and covered by a long, erect, tawny pubescence.

Head large, flat in front, a single supraorbital pore on each side, clypeal suture fine, not continued to eye; eyes separated from buccal fissure; labrum 6-setose, faintly emarginate; mandibles powerful, edentate, hooked and rather blunt at apex, no seta in the scrobe; mentum moderately emarginate and shortly toothed; ligula rather narrow, truncate, and bisetose at apex, a slight emargination separating it on each side from the paraglossæ, which are fairly wide, glabrous, membranous, and extend a little beyond the ligula; maxillæ sharp, hooked and glabrous at apex; palpi setulose, the two apical joints about equal in the maxillaries, the penultimate joint of the labials plurisetose and longer than the apical joint; antennæ moderately long, slender, pubescent, joints 1 and 2 less densely than the rest, 2 about half as long as the other joints, which are approximately equal. *Prothorax* convex, cordate. *Elytra* 9-striate, with a fairly long scutellary stria between 1 and 2, base bordered from the shoulder to stria 3. Prosternal process unbordered, setulose; venter shortly pubescent, the segments bisetose, last segment (♀) with a pair of marginal setæ on each side. Legs short, stout, pubescent; protibiæ with the fixed spur a little curved, bluntly pointed; tarsal joints short, pubescent above, joint 5 setulose beneath, 4 only faintly emarginate, joint 1 in the metatarsi equal to 2+3.

Genotype, *Panagrius hystrix*, sp. n.

This new Harpaline genus recalls *Eriotomus*, but the ligula is bi- instead of plurisetose, and compared with the species of that genus the body is more convex, the head and eyes larger, the antennæ shorter and more slender, and the long erect pubescence, when viewed sideways, is seen to be very dense.

Panagrius hystrix, sp. n.

Length 12-13.5 mm.

Piceous: palpi, antennæ, and legs ferruginous.

Head large, frontal impressions short and shallow, eyes fairly large but not very prominent, a tuft of hairs behind each, but the genæ are inappreciable, antennæ reaching basal fourth of elytra, surface less closely punctate on disk, more closely on clypeus, neck smooth. *Prothorax* a fourth wider than head, two-fifths wider

than long, widest before middle, base hardly wider than apex, which is moderately emarginate, sides rounded and gently sinuate before base, with a number of setæ, longer than the general pubescence, on the front half, front angles rounded and inconspicuous, hind ones approximately right, but slightly rounded; the usual impressions very slight, but the basal foveæ, which are rounded, are fairly deep, surface a little more finely and densely punctate than that of the head, disk only slightly less closely. *Elytra* with square shoulders and parallel sides, about a third wider than prothorax, a half longer than wide, barely sinuate near apex; striæ fairly deep, minutely crenulate, intervals moderately convex, the marginal series of pores sub-interrupted at middle, surface finely and rather densely punctate. A micro-sculpture of fine transverse lines is just appreciable on the elytra and prothorax. Underside shiny, much more finely punctate and pubescent than the upper surface; metepisterna bordered, twice as long as wide.

CENTRAL PROVINCES: Nagpur (*E. A. D'Abreu*), 3 ex. and another specimen in my collection, all ♀♀. BIHAR: Pusa (Pusa coll.), 1 ex., ♀.

In so far as there is any evidence, all the specimens seem to have been attracted to light in the evening, and I understand that the species of the genus *Eriotomus* are often taken under similar circumstances.

Key to the Species of *Dicælidus*.

- 1 (4). Prothorax with the lateral borders very narrow in front and only slightly dilated behind.
- 2 (3). Metepisterna fairly densely punctate... *nilascens* Tchitch. *.
- 3 (2). Metepisterna practically impunctate... *impunctatus* Bates †.
- 4 (1). Prothorax with the lateral borders narrow in front and strongly dilated behind (two or three times as wide).
- 5 (6). Prothorax with the sides straight behind, sometimes even faintly sinuate, the linear basal foveæ deep throughout and fully a third of the total length; elytra strongly opalescent..... *pernitidus* Chaud. ‡.
- 6 (5). Prothorax with rounded sides, the linear basal foveæ not deep throughout, the deep part not exceeding a fifth of the total length; elytra not strongly opalescent.

* Hor. Soc. Ent. Ross. xxxiv. 1900, p. 475.

† Ann. & Mag. Nat. Hist. (5), xvii. 1886, p. 145.

‡ Mon. des Oodes (ii.), Ann. Soc. Ent. Fr. 1882, p. 550.

- 7 (10). Prothorax a third wider than long, the basal foveæ parallel, the hind angles with a pore and seta.
- 8 (9). Antennæ with joints 3 and 4 equal; upper margin of scrobe of right mandible strongly dilated in the ♂ only; elytral striæ very deep even on disc in both sexes. *felspaticus* MacI. *.
- 9 (8). Antennæ with joint 3 longer than 4; upper margin of scrobe of right mandible moderately dilated in both sexes; elytral striæ only moderately deep on disk, at least in the ♀ *omestes*, sp. n.
- 10 (7). Prothorax a fourth wider than long, the basal foveæ converging a little forwards, the hind angles without visible seta, though a minute pore is present; right mandible ♂ ♀, without dilatation of the scrobe *collinus* Andr. †.

Dicæolindus omestes, sp. n.

Length 10·5–12 mm.; width 3·9–4·3 mm.

Black, shiny, only vaguely iridescent; palpi and joints 1–2 of antennæ more or less ferruginous, joint 3 of antennæ and tarsi piceous, rest of antennæ brown.

Head smooth, rather flat in front, frontal foveæ moderately deep, curving round sharply on each side to eye, eyes moderately convex, the genæ continuing the outline to neck, antennæ stout, extending rather beyond base of elytra, upper margin of scrobe of right mandible somewhat dilated in both sexes (less than in *felspaticus* ♂). *Prothorax* moderately convex, subquadrate, a half wider than head and about a third wider than long, base distinctly wider than apex, of which the median part is slightly emarginate, sides gently rounded and bordered, the border rather narrow in front, wider behind, but almost disappearing before base, a pore and seta on the hind angles, which are slightly obtuse and a little rounded; median line very faint, basal foveæ linear, parallel, fairly deep, not quite reaching base, surface smooth and impunctate. *Elytra* convex, oval, with very square shoulders, sides with a slight sinuation just before apex, only a little wider than prothorax, a half longer than wide; striæ fairly deep, impunctate, 2 arising in an umbilicate pore, intervals moderately convex on disk, much more convex near apex, where 7 and 8 are subcarinate, no dorsal

* Ann. Jav. 1825, p. 19, t. 1. f. 6.

† Journ. F.M.S. Mus. xvi. 1931, pp. 435 & 447, f. 6.

pores. The microsculpture of the elytra and prothorax consists of extremely fine lines forming wide meshes; on the head the meshes are isodiametric; further, the whole of the upper surface is microscopically punctulate. The extremity of the prosternal process (slightly) and the metasternal process are bordered; the proepisterna and sides of prosternum, metasternum, and venter are all punctulate; the metepisterna are impunctate, externally bordered, and about a half longer than wide; last ventral segment with one marginal seta on each side in the ♂, two in the ♀; tarsal joint 5 glabrous beneath.

I was able quite recently at the Paris Museum to compare the type of *D. nitescens* Tchitch. with an example of this species. *D. nitescens* is smaller and more iridescent, but the colours are similar. The head is similar, but with a narrower labrum. The prothorax is a little narrower, the front angles sharper and a little more produced, the emargination at the middle of apex less obvious, the lateral border very narrow and practically similar throughout, the basal foveæ a little longer and deeper, nearly reaching base. The elytra are a little narrower, the striæ slightly deeper and the intervals more convex. The metepisterna finely punctate.

SUMATRA: Sukaranda (*Dohrn*), 10 ex., ♂♀. The type is in the Stettin Museum.

Cymindis nobilis, sp. n.

Length 13.5 mm.; width 4.6 mm.

Piceous, shiny: palpi, antennæ, legs, metasternum, lateral margins of prothorax (very vaguely), epipleura, and an elytral pattern more or less ferruginous. The pale pattern on each elytron is formed by (i.) a marginal stripe, extending inwards to stria 7, (ii.) a large comma-shaped shoulder-spot, starting from above the shoulder on intervals 6-7, widening and curving inwards behind to stria 2, (iii.) an elongate-oval spot near apex on intervals 3-5. Surface generally sparsely pubescent.

Head wide, moderately convex, frontal foveæ shallow, eyes flat, genæ long, sloping very gently to neck, antennæ reaching basal fifth of elytra, apical joint of labial palpi (♀) only slightly dilated, surface (except neck) rather finely and not very closely punctate. *Prothorax* convex, cordate, a little wider than head and slightly wider than long, base arcuate, a little narrower than apex, sides narrowly

reflexed, rounded, and sinuate just before hind angles, which form a small, very obtuse, but fairly sharp tooth; median line and front transverse impression distinct, though shallow, basal foveæ fairly deep, disk hardly perceptibly, front and lateral margins moderately punctate, base rather closely rugose-punctate. *Elytra* flat, subovate, widest at apical third, nearly three-fourths wider than prothorax, about a half longer than wide, the rounded shoulders projecting forwards, the apex subtruncate; striæ moderately impressed, very faintly crenulate, 1 and 2 arising in an umbilicate pore, scutellary striae very short; intervals nearly flat, each with an irregular row of fine punctures. Microsculpture of the elytra isodiametric. Claws minutely pectinate.

This, the largest Indian species of the genus, has reached me since my "key" was published. This appeared quite recently ('*Stylops*,' i. 1932, pp. 126-7), and the new species should be placed next to *C. championi* Andr. (*nivicola* Andr., nom. præocc.).

KASHMIR: Khalatse, 15,000 feet, 1 ex., ♀, for which I am indebted to Prof. G. Hauser.

SOME NOTES ON A VISIT TO THE PARIS MUSEUM.

Anentmetus spissicornis Fairm. (Ann. Soc. Ent. Fr. 1888, p. 335).

I took with me an example of *A. pluto* m. (Ann. & Mag. Nat. Hist. (9) xiv. 1924, p. 586; Faun. Brit. Ind. Col., Carab. i. 1929, p. 166, f. 29) for comparison. Fairmaire's species is a little larger, the colour black, the epipleura, femora, and venter very dark red. Head nearly similar; prothorax with the front angles more rounded, the hind angles less sharp and not projecting laterally; the elytra longer and more evidently costate. The underside, labial palpi, profemora, and apex of venter exactly similar.

Dicranoncus pallidicornis Fairm. Compt. rend. Soc. Ent. Belg. 1891, p. 188 = *D. femoralis* Chaud. Bull. Mosc. 1850, i. p. 393.

As indicated in my Catalogue, I supposed that the type would be found in the Paris Museum, but I had not previously seen it.

Perigona angustata Fvl. }
Perigona annamita Fvl. } Rev. d'Ent. 1907, p. 104.

There was every reason to suppose that the types of these two species, as shown in my Catalogue, would be found in the author's collection at Caen, but to my surprise I came across them both in the Maindron collection, which is now at the Paris Museum.

Compared with the very common *P. annamita* (= *plagiata* Putz.), *angustata* is a little longer and relatively much narrower, uniformly ferruginous, except the head and the front margin of the prothorax, which are piceous. The sides of the prothorax are distinctly sinuate behind, so that the angles are sharp and hardly more than right. The elytra are long and narrow, with parallel sides, at least the first six striae distinctly visible and finely punctate, interval 3 with three dorsal pores.

Lasiocera coromandelica Maindr. Bull. Soc. Ent. Fr. 1906, p. 75.

Lasiocera malabarica Maindr. Bull. Soc. Ent. Fr. 1906, p. 76.

Both types were in the author's collection, which was acquired subsequently by Mr. G. Babault, and is now in the Paris Museum. Some years ago I saw both types in Mr. Babault's collection, and compared with *coromandelica* a specimen in my own collection. Having now, as I believe, an example of *malabarica* also, I took it with me for comparison, only to find that both types had meanwhile disappeared; it is to be hoped that they have only been misplaced and will be found again later on.

Harpalus advolans Nietn. Journ. As. Soc. Beng. xxv. 1856, p. 526 = *Ooidius advolans* Nietn.

I add this note here because in my Catalogue the species still appears under the original genus. A specimen which I sent some little time ago to Dr. Schauburger was identified by him as belonging to the African genus *Ooidius*, up to that time unknown to the Indian fauna, and in Mr. Csiki's recently published "pars 121" of his 'Coleopterorum Catalogus' the species is correctly placed under that genus.

XIII—The Nematode Genus *Ascarophis* van Beneden.

By H. A. BAYLIS, M.A., D.Sc., Department of Zoology,
British Museum (Natural History).

THE genus *Ascarophis* van Beneden is very imperfectly known. Although two species have been attributed to it, the male is unknown, and there seems to be no satisfactory description of the female of the genotype. During the examination of a number of fishes at the Laboratory of the Marine Biological Association at Plymouth, the writer found in the stomach of a gurnard (*Trigla lineata*), 26 cm. in length, two small slender worms which appear to belong to the genus *Ascarophis*, and in all, probability to the species, *A. morrhuae*, originally figured and very incompletely described by v. Beneden.

Van Beneden (1871) records this worm as a new species from the intestine and pyloric caeca of the common cod (*Gadus morrhua* [*Morrhua vulgaris*]). He gives figures of the anterior and posterior ends of the worm and of the eggs, but practically no description. All that he says about the species is contained in a footnote which reads as follows:—"Ce ver est extrêmement remarquable, d'abord par sa petite taille et ensuite par la forme effilée de l'extrémité céphalique. Toute la surface du corps est finement striée. Les œufs se distinguent de tous les autres par les filaments qui garnissent un des pôles." No measurements are given.

Nicoll (1907) records worms, which he refers to "*Ascaropsis*" *morrhuae* v. Beneden, from the haddock (*Gadus aeglefinus*), halibut (*Hippoglossus vulgaris*), and father lasher (*Cottus bubalis*). Only one specimen occurred in each of the last two hosts, but "in the haddock it was extremely numerous and was met with throughout the whole anterior part of the alimentary canal." Very few measurements are given in Nicoll's description of the worms, but their length is given as 6-8 mm. and their breadth as .8-.9 mm. The latter measurement should probably be 0.08-0.09 mm. The size of the eggs is given as 0.039-0.04 × 0.021-0.022 mm., and their measurements are said to have been almost uniform in the specimens from each of the three hosts. Nicoll observed that the cuticular "furrows" were

"continuous for more than one annulus." Van Beneden did not indicate this definitely in his figures, but many of the rings were shown as being oblique, and this appearance is highly characteristic of the genus. Nicoll further states that towards the anterior end the "furrows" become faint and disappear. Another point mentioned by Nicoll, but not indicated by van Beneden, is the presence on the head of two small, forwardly-directed "spines." The long oesophagus is mentioned by Nicoll, but he does not describe the long tubular pharynx which is fairly clearly figured by van Beneden.

Nicoll's account of the female genital organs is rather incomplete. The position of the vulva does not seem to have been determined, and only one ovary (originating at the posterior end of the body) is mentioned. Both v. Beneden and Nicoll describe the eggs as being provided with filaments or flagella at one pole. According to Nicoll, each egg has two such flagella.

Cobb (1928), after referring to the observations of v. Beneden and Nicoll, gives an account of a species which he regards as new, and names *Ascarophis helix*, from the gills of a sting-ray (*Dasyatis centrura*). His paper is mainly taken up with theoretical considerations as to the nature and origin of the "spiral" arrangement of the cuticular striations. The anterior and posterior ends of the worm are figured. Very few actual measurements are given. The length of the worm (apparently a single female) was 13.2 mm. The average size of the eggs was 0.04×0.024 mm. Certain other measurements can be obtained by calculation from the "formula" given at the beginning of the description*. In this way the writer has arrived at the following actual figures (in millimetres):—

Maximum thickness	0.1584
Anterior end to end of pharynx.....	0.1452
" " " oesophagus	3.026
" " " nerve-ring	0.198
Length of tail	0.0264
Vulva to posterior end	5.676

The description mentions two prominent, conical, lateral, forward-pointing labial projections, a slit-like

* In Cobb's "formulae" the distances from the anterior end to various points, and the diameter of the body at these points, are given in units representing hundredth parts of the total length.

mouth, a shallow groove-like "vestibule," a long, uniform, tubular pharynx, and an oesophagus consisting of an anterior non-granular and a posterior granular portion. At $4-5\ \mu$ behind the tips of the cephalic projections there is a pair of "amphids" or lateral organs, represented by exceedingly minute openings. "The excretory pore is an opening of considerable size, taking up the space of about three annules of the cuticle."

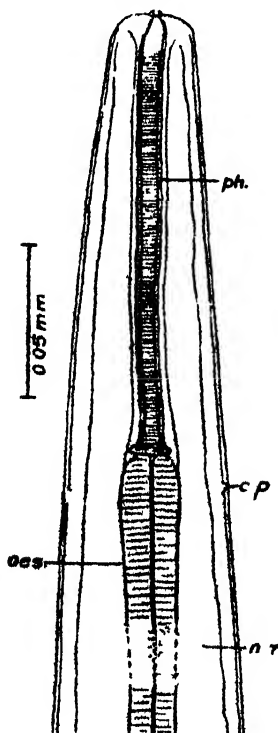
The vulva is "a transverse ellipsoidal affair... interrupting two to three of the spirals." "There is a *single ovijector* of considerable length passing inward from the vulva; apparently the ovijector is several times as long as the body is wide—say at least three times. Its walls are thick and muscular." The polar flagella noted by v. Beneden and by Nicoll were not seen on the uterine eggs. As to this Cobb remarks that "it is possible that appendages might arise later, e. g. from some vaginal secretion coagulated during deposition." The eggs, according to Cobb, contain fairly well developed embryos *in utero*.

The foregoing is a summary of all that appears to be known at present of the genus *Ascarophis*. So far as it goes, there is little evidence of the existence of more than one species. The writer's specimens from the gurnard measure 11.2 and 13.2 mm. in length respectively. The maximum thickness of the smaller specimen occurs at the vulva, and is 0.085 mm. In the larger specimen the thickness is greatest at a point somewhat behind the vulva, where it is 0.11 mm. At the vulva the thickness is 0.1 mm. The length of the worms is therefore similar to that of Cobb's *A. helix*, while their thickness is nearer to that of Nicoll's *A. morrhuae* (assuming that his decimal points have been displaced).

The diameter of the head is about 0.0275 mm. The lips are scarcely distinguishable, but the small, paired, lateral projections described by Nicoll and by Cobb are present. These are narrow, whether viewed dorso-ventrally or laterally. In Cobb's figure they appear much broader at the base, and this may possibly indicate a specific difference. The distance from the anterior extremity to the end of the oesophagus, in both specimens, is 3 mm. The distance from the same point to the end

of the pharynx is 0.15 mm., and to the end of the anterior, muscular portion of the œsophagus 0.62 mm. The nerve-ring surrounds this part of the œsophagus at a distance of 0.21 mm. from the anterior extremity,

Fig. 1.



Ascarophis morrhuae v. Beneden. Anterior end of female:
dorsal view.

c.p., cervical papilla; n.r., nerve-ring; œs., œsophagus;
ph., pharynx.

and the excretory pore is situated at 0.3–0.32 mm. from the same point. There is a pair of faintly distinguishable cervical papillæ (the "deirids" of Cobb), just behind the junction of the pharynx and œsophagus.

The mouth is laterally compressed. The cuticular

lining of the pharynx is mainly cylindrical and has a diameter of about $7.5\ \mu$, except at its extremities. At the posterior end it widens gradually to about $10\ \mu$, and at the anterior end it expands rather suddenly, as seen in lateral view, to about the same width, thus forming the "vestibule" referred to by Cobb. When seen in dorso-ventral view, however, the lateral walls converge anteriorly. The cuticular tube is transversely striated throughout its length. The anterior portion of the oesophagus is muscular and non-granular. Just behind its junction with the pharynx it has a diameter of about $25\ \mu$. At the level of the nerve-ring it narrows to 17.5 or $20\ \mu$, and then gradually expands again posteriorly to a maximum of 25 – $27\ \mu$ where it passes into the posterior portion. This is granular, and has a maximum diameter of 50 – $63\ \mu$, almost completely filling the body-cavity.

The cuticular striations are of the characteristic kind. Their "spiral" nature is, in the writer's opinion, more apparent than real, and is due to the fact that anastomosis very frequently occurs between adjacent "rings." The striations on the extreme anterior and posterior ends of the body are relatively fine and faint. They become very prominent at a point a little behind the excretory pore, and remain so as far as the vulvar region. In the oesophageal region, where they are most conspicuous, the intervals between adjacent "rings" are about 5 – $7\ \mu$. Posteriorly the intervals gradually decrease, and the rings become fainter and more regularly transverse.

The tail measures 0.065 – 0.07 mm. in length. It is conical and diminishes suddenly at the tip to form a small nipple-like terminal appendage. Close to the base of this appendage there is a pair of small caudal papillæ, whose peduncles are nearly parallel to the longitudinal axis of the tail. The vulva, which is very slightly salient, is situated at about 4 – 4.4 mm. from the posterior end. The vagina is rather stout and muscular, and runs posteriorly from the vulva for a distance of about 0.2 mm., where it gives off two uterine branches. One of these immediately turns anteriorly, while the other runs straight back towards the posterior end. The anterior ovary is reflexed at a point a little in front of the junction

of the œsophagus and intestine, the posterior at about 0.18 mm. from the posterior end of the body. The eggs, as seen *in utero*, measure about 0.0375–0.04 mm. \times 0.0225–0.025 mm. Their shells are relatively very thick. Polar filaments could not be made out, but it is possible that they may become visible when the eggs are laid. So far as could be made out, the eggs do not contain fully-formed embryos *in utero*.

Taking into consideration the apparent difference in the shape of the cephalic projections, and the differences in the thickness of the body, the length of the tail and the position of the vulva, it appears possible that the species here described is distinct from *A. helix* Cobb. So little is known of the original *A. morrhuae* that it is impossible to say that the present specimens do not agree with that species. It must, therefore, be assumed for the present that they are *A. morrhuae*.

SYSTEMATIC POSITION OF THE GENUS *ASCAROPHIS*.

Both Yorke and Maplestone (1926) and Baylis and Daubney (1926) found it impossible to assign the genus *Ascarophis* to any of the families of Nematodes defined by them. It was placed by Yorke and Maplestone among "Spiruroidea insufficiently known," and by Baylis and Daubney in an appendix to the order Filarioidea (which, in their system, includes the superfamilies Spiruroidea and Filarioidea recognized by Yorke and Maplestone). The authors of both systems were led by Nicoll's description to suppose that in this genus the vulva was anteriorly placed and the genital tube single.

In the absence of knowledge of the structure of the male, it still seems impossible to assign the genus to a definite position. In view, however, of the fuller accounts of the female now available, it seems to have certain affinities with the genus *Spinitectus* Fourment, 1883, the members of which are also parasites of the alimentary canal of fishes. *Spinitectus* is placed by Yorke and Maplestone in the family Rictulariidae of Railliet, along with *Rictularia* and three other apparently aberrant genera, *Rictularioides*, *Pneumonema* and *Echinonema*. The writer is unable to accept the family Rictulariidae—at least, in this sense. It seems probable that the

five genera mentioned, although all armed with cuticular spines, are not, in reality, at all closely related to each other. Until they have all been more fully investigated, it is useless to speculate further upon their relationships, but the subfamily Thelaziinæ of the family Spiruridæ (or the family Thelaziidæ of some authors) seems, as pointed out by Baylis and Daubney (1926), to be a group to which some of them, at least, approach rather closely.

The generic diagnosis of *Ascarophis* given by Baylis and Daubney may be emended as follows :--

ASCAROPHIS van Beneden, 1871.

Body of female relatively elongate, slender, and of almost uniform thickness except at the extremities. Cuticle, except at the extremities, with prominent annulations which tend to assume a spiral arrangement. Lips paired, inconspicuous, each bearing a small, forwardly-directed, conical process. A long, tubular pharynx present. Œsophagus long, consisting of two portions. Tail short and conical. Vulva at about the posterior third of the body. Uterine branches opposed. Oviparous. Eggs, when laid, provided with filaments at one pole. Male unknown.

Habitat.—Alimentary canal of marine fishes.

Genotype.—*A. morrhue* van Beneden, 1871.

The writer takes this opportunity of expressing his best thanks to Dr. E. J. Allen, F.R.S., for allowing him the use of a table at the Plymouth Laboratory, and for the kindly interest that he took in his work.

REFERENCES.

- BAYLIS, H. A., & DAUBNEY, R. 1926. "A Synopsis of the Families and Genera of Nematoda." London: British Museum (Nat. Hist.).
- BENEDEN, P. J. VAN. 1871. "Les Poissons des Côtes de Belgique, leurs Parasites et leurs Commensaux." Mém. Acad. Roy. Sci. Belg. xxxvii. 4, pp. xx+100, pls. i.-vi.
- COBB, N. A. 1928. "The Screw-nemas, *Ascarophis* van Beneden 1871; parasites of codfish, haddock and other fishes." Journ. Washington Acad. Sci. xviii. pp. 96-102.
- NICOLL, W. 1907. "A Contribution towards a Knowledge of the Entozoa of British Marine Fishes." Ann. & Mag. Nat. Hist. (7) xix. pp. 66-94, pls. i.-iv.
- YORKE, W., & MAPLESTONE, P. A. 1926. "The Nematode Parasites of Vertebrates." London.

XIV.—*New Triassic Palæoniscids from Madagascar.*

By ERROL IVOR WHITE, Ph.D., F.G.S., Assistant Keeper, British Museum (Nat. Hist.).

AMONG the specimens collected by M. Chevallay and myself from the fish-bearing strata of North-east Madagascar are a number of Palæoniscids, which by reason of their excellent preservation are worthy of special notice. These specimens are in the form of external moulds in ferruginous clay-nodules and generally show the finest details, although sometimes these are obscured by mineral infiltrations. Both sides of the fishes are usually preserved; nevertheless, it is not easy to ascertain their true shape, for they are invariably much compressed laterally and the region immediately behind the head telescoped. Moreover, the complete tail is preserved in no specimen.

The characters of the heads of these Palæoniscids are very striking and, within the limits of minor variation, constant, so that on the evidence of the skulls alone all these specimens would without question be considered to be conspecific: yet a study of the bodies and fins shows clearly that there are two species.

Genus *PTERONISCULUS*, nov. (Figs. 1 & 2.)

Diagnosis.—Palæoniscidæ with fusiform bodies, long heads, and large orbits anteriorly placed. Gape wide and suspensorium very oblique. Frontals long with extremely irregular medial and digitate parietal sutures; parietals well developed with short triradiate sensory grooves and produced forwards into conspicuous median "processes." Preoperculum bent almost at right-angles, with upper horizontal limb long and roughly triangular, but truncated by supratemporal margin; long wedge-shaped bone "Y" in excavated antero-superior margin of operculum. Supratemporal large with anterior arm dividing strap-like intertemporal from frontal; four or five postorbital bones present. Teeth on outer margins of maxilla and dentary numerous, minute and sharply pointed. Fin-rays fine and very numerous, articulated distally in pectorals, but throughout in other fins; all distantly dichotomized; fulcra minute. Pectoral fins

Fig. 1.

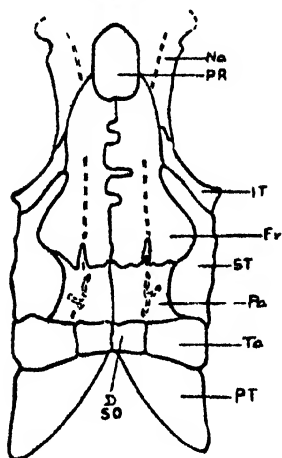


Fig. 2.

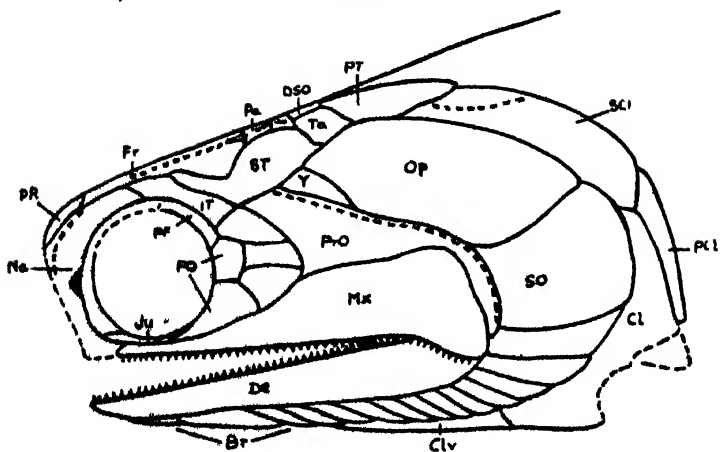


Fig. 1.—Restoration of the skull-roof of the genus *Pteronisculus*.
× approx. 2 diam.

Fig. 2.—Restoration of head and pectoral girdle of the genus *Pteronisculus*, lateral view. × 2 diam.

(For explanation of lettering, see text.)

large, their length exceeding distance between their origin and that of ventral fins, which is somewhat nearer pectoral than anal fins; ventral and unpaired fins well developed, the triangular dorsal being posteriorly placed and somewhat anterior in position to similarly-shaped anal. Posterior half of caudal fin unknown. Scales small and numerous, deeply overlapping, rhomboid in shape, their exposed surfaces covered with ganoine, obliquely ridged, and denticulated posteriorly.

Genotype.—*P. cicatrosus*, sp. n.

Remarks.—The head-regions of the two species described below are indistinguishable so far as our present knowledge goes, the forms differing only in the shape of the body, the size of the pectoral fins, the position of the unpaired fins, and in the ornamentation of the scale.

These species have a number of features which are very characteristic, so that there seems little doubt that they belong to a new genus: the skull-characters are quite distinctive, and the large pectoral fins, the fineness of the fin-rays, and the small size of the scales serve clearly to differentiate these forms from all other Palaeoniscids, Triassic or otherwise, with which they may be compared.

Pteronisculus cicatrosus, sp. n. (Fig. 3.)

Diagnosis.—A *Pteronisculus* with fusiform body; maximum depth about equal to length of head with opercular apparatus, and rather less than one-third of total length to base of caudal fin. Length of pectoral fin somewhat less than distance between tip of snout and hinder margin of maxilla. Origin of dorsal fin above thirty-fourth scale-row from pectoral girdle approximately. Scales in about fifty-five vertical rows to base of caudal fin, and ornamented with oblique rugæ and a few finer rugæ running parallel to lower margin of scale on main flank-scales.

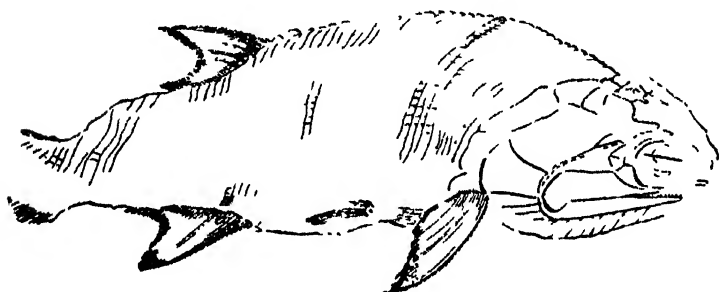
Material.—The holotype, the external impression of an almost complete fish in counterpart (Brit. Mus. nos. P. 16300-1), and fourteen other specimens.

Formation and Locality. Lower Trias: Ambarakarak and (?) Andogozobé, south of Diego Suarez, North-east Madagascar.

Description.—The measurements of the holotype, which is from Ambarakarak, are as follows:—Length from snout to caudal pedicle 11.5 cm. (the fish is slightly telescoped in the region immediately behind the head); maximum depth 3.5 cm.; depth of caudal pedicle 1.2 cm.; length of head to hinder margin of opercular apparatus 3.9 cm. No specimen is appreciably larger than this.

The skull-roof is complete and arched from side to side, although to what degree it is impossible to say, but the state of preservation suggests that the fish was

Fig 3.



Pteronisculus cicatrous, gen. et sp. n.

Sketch of the holotype with additions from its counterpart.
[Brit. Mus. nos. 16300 1.] Nat. size.

round-bodied and the arching of the skull-roof therefore not very strong. The head is nearly twice as long as deep. The parietals (*Pa*) are well developed, about as wide as long, with straight medial and posterior margins, concave outer (supratemporal) margins, and very digitate anterior sutures, these having strong, forwardly-directed median processes where the supra-orbital sensory canals enter the frontals. The frontals (*Fr*) are of moderate size and about twice as long as wide posteriorly; their outer margins are sinuous, being in contact with the long and generally excavated upper border of the supratemporal, the short upper border of the intertemporal, and the upper posterior border of the nasal, and are thus excluded from contact

with the circumorbital series. The median frontal suture is remarkably irregular and varies from specimen to specimen, while the posterior margins are deeply incised to receive the parietal "processes." Anteriorly the frontals are excavated for the azygous post-rostral (*PR*), a relatively large and more or less oval bone which turns down anteriorly to form the point of the snout. In front of this bone the details are unknown, but on each side is a nasal (*Na*), the anterior limits of which are obscure, although the lateral margin is shown in several specimens in contact with the circumorbital series and doubtless continues down to the missing rostrals; about the level of the centre of the orbit it has a conspicuous notch for the nostril. Posteriorly this bone is in contact with the intertemporal (*IT*), a strap-like bone lying for the most part between the circumorbitals and the supratemporal, and having contact for short distances with the frontal above and a postorbital below. The supratemporal (*ST*) has a curious shape, which varies a little owing to the inconstancy of the superior (frontal) border; this is, however, in most specimens excavated, and there is thus a narrow oblique anterior limb. The intertemporal margin is regular, continuing the line of the postorbital-preopercular suture, while the inferior margin is gently sinuous where the bone abuts successively against the preoperculum, bone "Y," and the operculum. The skull-roof is completed by a tabular row comprising a pair of large, wide tabulars (*Ta*) and a smaller pair of dermo-supra-occipitals (*DSO*).

The circumorbital series is fairly well shown. The postfrontal (*PF*) is a long narrow bone below the intertemporal. It is continued forwards by similar bones doubtless representing the prefrontal and the lachrymal, but the sutures between them are not to be seen. Below the nostril the circumorbital broadens and meets the long and extremely narrow jugal (*Ju*). The area between the orbit and the preopercular and maxillary expansions is covered by a series of four or five postorbitals (*PO*), the number and shape of which differ according to the individual. Usually the postfrontal is succeeded below by a squarish bone somewhat taller than broad, and between this and the jugal is the largest bone of the

series, roughly triangular in shape. Above and behind these, as a rule, are two or three variously-shaped elements.

The expanded horizontal upper limb of the preoperculum is very long and roughly triangular in shape, but its antero-dorsal angle is truncated by the supratemporal contact. The lower limb is, as usual, short, narrow, and almost vertical. The rest of the cheek is covered by the posterior maxillary expansion, which is very wide, in keeping with the elongated form of the head. The oral margin of the maxilla is straight except posteriorly, where it is deflected downwards over the lower jaw; throughout it is armed with numerous, very small, sharply pointed teeth, similar to those on the outer margin of the dentary. The premaxilla and its dentition are unknown.

The operculum (*Op*) is more nearly horizontal than vertical in position and more than twice as deep as wide. Its shape is normal, except that the antero-dorsal angle is cut away to make room for the bone "Y," which in this instance is very obviously part of the opercular series, for its anterior and superior margins continue the lines of the operculum, of which it seems to form part. Its opercular margin is rather sinuous and apparently overlaps the larger bone. The suboperculum is somewhat wider than the operculum, and its width much exceeds its maximum depth, which is at the convex hinder margin. Below it are a series of twelve or thirteen well-developed branchiostegal rays, of which the most dorsal is slightly, and the most anterior very much, broader than the others. The series is headed by a single azygous plate.

Apart from a fragment of the parasphenoid, no internal structures of the head are preserved.

The sensory canals are deeply lodged and rarely visible on the external impressions. In some specimens, however, the passage of the main canal may be traced through the supracleithrum, but no further, and the course of the suborbital branch is not visible, although the hyomandibular is frequently seen when the bone is preserved, as an internal ridge running close to the hinder margin of the preoperculum. The supraorbital canal passes backwards from near the nostril through the nasals and the posterior

part of the frontals to the parietal "processes," through which it enters the parietal bones. The most conspicuous and constant feature of the sensory system is the tri-radiate group of canals occurring about the centre of each parietal. These consist of three short curved grooves, one directed forwards, one antero-laterally, and one postero-laterally. This group apparently corresponds to the line of pit-organs in *Amia* innervated by the dorsal branch of the glossopharyngeus. I have not seen it in other Palæoniscids, although simpler forms occur in some Catopterids, such as *Helichthys* (J. Brough, P. Z. S. 1931, pp. 249, 257, text-figs. 5, 9).

Most of the bones of the head are strongly ornamented with short broken striæ and tubercles, running generally parallel with the major axes of the bones; on the upper part of the maxillary expansion, the opercular apparatus, and the branchiostegal rays the ornament is generally much sparser than elsewhere, consisting of widely separated tubercles. The bones of the shoulder-girdle are heavily ornamented in a way similar to the bones of the skull-roof, but on the supracleithrum there is some tendency to herring-bone arrangement.

The pectoral girdle is seldom well preserved and the form of its constituent bones is a little uncertain, except in the case of the large and triangular post-temporal (*PT*). The supracleithrum (*SCl*) is very deep and narrow, and the cleithrum (*Cl*), so far as can be judged, powerful and deeply notched in front of the fin; the clavioles (*Clv*) are very long and triangular. Behind the girdle is a very deep and narrow postcleithral scale (*PCl*) reaching from the supracleithrum to the cleithral notch.

The fins are composed of very fine and numerous rays, and bear along their anterior margins series of very small fulcra. The fin-rays are all distally dichotomized and, except in the pectorals, more or less evenly jointed throughout, the articulations occurring at distances equal to three or four times the width of the rays. In the pectoral fins, however, all the rays but the hindmost are without articulations until near the tips.

The pectoral fins are large, exceeding 2.2 cm. in length in the holotype, but the full number of rays, approximately forty, is not shown in this specimen. Apart from a few short rays in front, the anterior rays are the

longest, and from them the length decreases rather rapidly, the last twenty or so being quite short.

The ventral fins in this species are seldom well preserved. They are placed rather far forward, nearer the pectorals than the anal, and are long-based. They consist of upwards of thirty rays, which are gently graduated.

The dorsal fin is posteriorly placed, its origin in the holotype being above the thirty-fourth scale-row from the pectoral girdle and about 7.4 cm. from the tip of the snout. It is triangular with an excavated posterior margin, and comprises at least forty rays, of which the longest is about the seventh or eighth. In the holotype the length of its base is 1.8 cm. and that of the longest fin-ray 2.0 cm.

The anal fin is slightly posterior in position to the dorsal, which it closely resembles.

Little can be seen of the tail beyond the pedicle and the anterior rays, which are similar in character to those of the other unpaired fins.

The squamation is perfectly regular. It is arranged in about fifty-five vertical rows to the base of the caudal pedicle, and about fifty horizontal rows. The overlap of each of these small scales is very large, so that normally only half the surface is exposed. The exposed surface of the main flank-scales is rather higher than wide, but the height decreases rapidly above and below these, so that the back and belly are covered with many rows of extremely shallow scales. The ornament of the flank-scales consists of a number, up to about ten, of well-defined oblique rugæ, ending in denticulations at the hinder margin; but below these, running parallel to the inferior border, are a number of finer ridges. On the other scales usually the diagonal rugæ alone are found, and towards the caudal pedicle the ornament tends to become much less distinct.

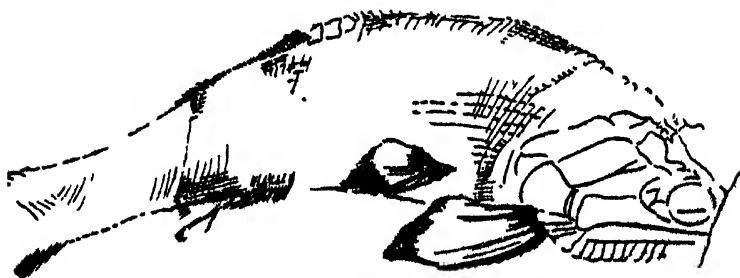
Behind the large postcleithral scale is at least one row of enlarged scales. There are no ridge-scales on the body, except for a series of three enlarged scales in front of the dorsal fin and three, one followed by a pair, similar scales in front of the anal. The usual series of elongated ridge-scales protects the dorsal margin of the tail and caudal pedicle.

Pteronisculus macropterus, sp. n. (Fig. 4.)

Diagnosis.—A *Pteronisculus* with elongate-fusiform body; maximum depth rather less than length of head with opercular apparatus, and equal to one-quarter total length to base of caudal fin. Length of pectoral fin exceeding distance between tip of snout and hinder margin of maxilla. Origin of dorsal fin above fortieth scale-row from pectoral girdle approximately. Scales in more than seventy vertical rows to base of caudal fin, and ornamented with oblique rugæ only.

Material.—The holotype, the external impression of an almost complete fish in counterpart (Brit. Mus. nos. P. 16282-3), and fourteen other specimens.

Fig. 4.

*Pteronisculus macropterus*, gen. et sp. n.

Sketch of the holotype with additions from its counterpart. The ventral fin is dorsally displaced. [Brit. Mus. nos. P. 16282-3.] Nat. size.

Formation and Locality.—Lower Trias: Ambarakaraka, Anabaranano, Andogozobé and Bobasatrana, south of Diego Suarez, North-east Madagascar.

Description.—The measurements of the holotype, which is from Ambarakaraka, are as follows:—Length from snout to caudal pedicle approximately 12 cm.; maximum depth 3.2 cm.; depth of caudal pedicle 1.4 cm.; length of head to hinder margin of opercular apparatus approximately 3.5 cm. The details of the head and pectoral girdle are so similar to those of the genotype that to describe them would be so much repetition. Indeed, the two species are so alike that the only points that

need be noted here are those that amplify the diagnostic characters.

The dorsal fin is not well preserved in any specimen ; in the holotype the base of the fin is 2 cm. long and its origin is about 7.5 cm. from the tip of the snout. The exact number of fin-rays cannot be determined, but it was scarcely less than fifty. The anal fin in the holotype has a slightly longer base, and shows the remains of about a dozen stout radials. It closely resembles the corresponding fin of the genotype.

The pectoral fins are extremely large. In the nature and number of the fin-rays they resemble those of *P. cicatrosus*, but are considerably longer, for the anterior long rays reach far behind the level of the ventrals. In the holotype they are distally imperfect, but even so they exceed 2.5 cm. in length ; at least thirty-five rays and three radials are preserved.

The ventral fins are better displayed in this species than in the genotype. No less than thirty rays are to be seen in the type-specimen, of which the longest exceeds 1.8 cm. in length. As preserved, the origin of this fin is 1.5 cm. from the pectoral fin and 2.2 cm. from the origin of the anal fin.

The only points that need be noted concerning the squamation are the increase in the number of vertical rows, about seventy-two in the holotype, and the absence of the inferior horizontal ridges of the ornament on the flank-scales, of which the tallest, those of about the twenty-fifth horizontal row from the median dorsal line, bear the lateral line. They are not more than 0.15 cm. high in the holotype.

This species is quite easily distinguished from the genotype, when fairly complete specimens are available, by the scale-ornament, the size of the pectoral fins, the shape of the body and the position of the median fins, and the number of scale-rows and the scale-ornament ; but in distorted specimens with imperfect fins and worn ornament, which is the usual condition, it is often impossible to be certain of the species, although the genus, owing to the commonly excellent state of preservation of the head, is always obvious.

Remarks.—In spite of the very large number of Palaeoniscid genera which have been described at one

time and another, of only about half-a-dozen have the skull-roofs been described and figured in detail. It is therefore at the moment rather difficult to say to which of the other members of the family any particular Palæoniscid may be allied, especially as those which have been figured show a diversity in detail almost as remarkable as their conformity to general type. The head of *Pteronisculus* differs considerably from those of *Cheirolepis* (D. M. S. Watson, P. Z. S. 1925, pp. 817-9), *Elonichthys* (D. M. S. Watson, P. Z. S. 1928 p. 57), *Gyrolepis* (E. Stolley, 1920, 'Palæontographica,' lxiii. pl. xi. fig. 4), *Coccocephalus* (D. M. S. Watson, P. Z. S. 1925, pp. 827-8), *Birgeria* (E. A. Stensio, 1932, Trias. Fishes E. Greenland, pp. 100-12), and *Dicelopyge* (J. Brough, P. Z. S. 1931, p. 240), but seems to resemble what we may call the normal Palæoniscid type, as exemplified by *Nematoptychius*, *Palæoniscus* (R. H. Traquair, 1877, Ganoid Fishes Brit. Carb. Form. pl. i.), and *Oxygnathus* (D. M. S. Watson, P. Z. S. 1925, p. 867, and 1928, p. 59), but whether these forms constitute a natural group within the family is by no means certain, for other factors than skull-characters must be taken into consideration. The retention by some of these forms of typically Palæoniscid head-structures as late as the Trias and Lias is, however, interesting, in that it suggests that we are here dealing with members of a sterile branch or branches of the family.

XV.—*The Tachinid Genus Doddiana Curran (Diptera).*

By JOHN R. MALLOCH.

THIS genus was erected in 1927 for the reception of one species, *pallens* Curran, from Australia *. Curran's paper appeared in August, and in October of the same year a paper of mine was published in which I erected the genus *Semisuturia* for the reception of several Oriental and one Australian species, with the genotype, *australis* Malloch, from Australia †. I afterwards synonymized the genera, though I suggested the possibility that they might be regarded as subgenera ‡.

* Ent. Mitt. vol. xvi. no. 5, p. 353.

† Proc. Linn. Soc. N.S.W. vol. lii. pt. 3, p. 340 (1927).

‡ L. c. vol. lv. pt. 3, p. 340 (1930).

Townsend subsequently stated that the two species cited above were "apparently" synonyms of *Tachina mellea* Wiedemann, described from Java *. He stated further that "It is a question whether the seven additional species described by Malloch under *Semisuturia* from the Oriental Region are distinct from *mellea*, which appears to be an old and variable species extending from Malaysian mainland to Australia."

It is not clear from Doctor Townsend's various papers whether he has ever examined any specimens but the two genotypes above referred to, the three Wiedemann, and one other Javanese specimen, but I infer that he has not, and I know that he did not have the various specimens together for comparison at any one time. His examination of *australis* was made in a rather hasty manner in Washington, and I am convinced his deductions are entirely at fault as to the synonymy of the material I still have before me, which contains the types of all species described by me, a specimen of *pallens* Curran, compared with the type, and one identified as *mellea* by Townsend which belongs to the Deutsches Entomologisches Institut. This last specimen is in perfect agreement with the type of *hyalipennis* Malloch, except for the bristles on first tergite. It appears, at least to me, unwise to accept this species as *mellea* because of lack of mention in the original description of the deep black central apical mark on the third and fourth visible tergites, which, though small, are quite readily seen with a low-power lens, and the entirely hyaline wings do not justify the supposition that they would be described by Wiedemann as "gelblich, Spitze an der Rippe und gewöhnlichen Queerader rauchgrau." In fact, the description of the wings more distinctly suggests the species I described as *triangulifera* than it does the species accepted as *mellea* by Townsend.

It falls to me to describe one additional species and place on record some new localities for some of the other species, and in doing so I present a more elaborate and extended synopsis than that in my paper in 1927 above referred to.

* Ann. & Mag. Nat. Hist. ser. 10, vol. vii. p. 369 (1931).

Key to the Species.

1. Fourth wing-vein sharply angled and with a well-developed vein projecting in direct continuation of the basal portion at the preapical bend, the spur-vein extending over midway to the margin of the wing 2.
 Fourth wing-vein with a narrowly rounded preapical angle, and only exceptionally with a very inconspicuous spur-vein at that point, which is not longer than the diameter of the vein 5.
2. First to third visible tergites each with a pair of central apical bristles, the second and third also with a pair of bristles on the disc, which are spaced similar to the apical central pair; antennæ yellow; thorax yellow, with four subcontiguous black vittæ on the anterior two-thirds of the mesonotum; abdomen with base yellowish, and apical half or more shining black, the fourth visible tergite not yellow nor noticeably depressed in centre at apex; wings yellowish, darker costally, slightly greyish apically; length about 9 mm. *nitidiventris* Malloch.
- First to third visible tergites each with a pair of long apical central bristles and no discal pair, the third with the same complete apical series as all the other species. 3.
3. Third antennal segment entirely black, contrasting sharply with the basal segments, which are yellow; abdomen glossy brownish black, sometimes more or less evidently yellow at extreme base, and with the apex of fourth visible tergite yellow, the anterior margin of the yellow mark irregular in outline; mesonotum of female with four broad, interrupted, black vittæ which do not extend to posterior margin, that of the male with the disc broadly black on entire length, the dark colour staining the base of the scutellum; wings slightly yellowish, veins yellow, becoming slightly darker apically; abdomen broadly ovate in both sexes *nitricornis* Malloch.
- Antennæ entirely yellow; mesonotum entirely, abdomen extensively, yellow 4.
4. Robust species, abdomen broadly ovate, as broad as long, entirely yellow; wings yellowish hyaline, hardly more yellow costally, the veins brownish yellow, not strikingly paler basally; mid-femur with some fine bristles on the apical third or less of the anteroventral and posteroventral surfaces that are not very closely placed and do not form a definite fringe or comb; length about 7 mm. *flavicornis* Malloch.

Slender species, abdomen narrowly ovate, fully as long as broad, with deep black dots surrounding the bases of the central two, and two of the lateral, bristles on second visible tergite, an apical fascia of same colour on the third, which is narrowly broken on the central line, on each side of which interruption it is slightly widened, and black dots surrounding the bases of the preapical bristles on fourth tergite; wings pale brown, darkened to costa, the veins dark brown, slightly paler at bases; mid-femur with some rather strong, closely placed bristles on the apical third or less of the anteroventral and posteroventral surfaces which form a sort of comb, much as in many species of the genus *Sarcophaga* Meigen, but not as strong as is usual in that group; length 6 mm., wing 7.5 mm.

5. Upper half of back of head entirely yellow; third antennal segment black, or very dark brown, at most with the extreme base yellowish

punctigera, sp. n.

Upper half of back of head broadly black on each side or entire width

6.

6. Abdomen entirely yellow

7.
australis Malloch.

Abdomen yellow, with a deep black mark on each side of apex of third and fourth tergites, which extend over the lateral curve, and are visible both from above and below

[*ventris*, nov.
australis var. *maculi*-

7. Second division of the costa, i. e., that between the apices of the subcostal and first vein, not over half as long as the first division; third antennal segment black, not over 1.5 as long as second when seen on the inner side

8.

Second costal division about two-thirds as long as first; third antennal segment over 1.5 as long as second when seen on inner side

9.

8. Frons lemon-yellow on central stripe, yellowish white on orbits, its width at vertex over half as great as its length in centre; abdomen largely glossy black on dorsum (female)

flavifrons Malloch.

Frons brownish red on central stripe, reddish yellow on orbits, but the latter with quite dense white dusting, which partly obscures the ground-colour; width of frons at vertex not half as great as its length in centre; abdomen entirely yellow (female)

pallens Curran.

9. Dorsum of abdomen preponderantly black, at least the apical two-thirds of second, all of third, and the anterior half or more of fourth visible tergites of that colour; general colour brownish yellow, the

- black on abdomen extending over ventral portion of at least the fourth tergite; first visible tergite without a central apical pair of bristles 10.
- Dorsum of abdomen almost entirely yellow, sometimes with the second visible tergite browned apically and the third largely so, the fourth with at most a small black apical central dark triangle; general colour paler, testaceous-yellow..... 11.
10. Smaller species, about 6 mm. in length; frons at vertex in female not over half as wide as one eye, the orbits grey, with white dusting; third antennal segment black, the base very narrowly reddish on the inner side only; first visible tergite of abdomen very faintly yellowish in front, fourth with the apical third or more conspicuously yellow, the pale part quite sharply marked off basally, with a central spur of the dark colour carried forward wedge-like *pahangensis* Malloch.
- Larger and more robust species, about 9.5 in length; frons at vertex in female slightly over half the width of one eye, the orbits distinctly blackened on upper half or more, yellow in front, and with whitish dusting over all; third antennal segment dark brown or fuscous, orange-yellow at base on outer and inner sides, more extensively so on the latter, especially in the female; first visible tergite infuscated only at apex in both sexes, second in male yellow at base, fourth in both sexes rather indistinctly and irregularly brownish yellow on apical third or more, the pale colour not sharply differentiated from the dark part *sumatrana* Malloch.
11. First visible tergite of abdomen with a pair of well-developed apical central bristles; wings greyish hyaline, veins pale brown, yellowish basally; abdomen with a small black triangular mark on third and another on fourth visible tergite which is situated between the apical central pair of bristles, second with such a spot hardly traceable; antennae entirely yellow, third segment about 1.75 as long as second *hyalipennis* Malloch.
- First visible tergite of abdomen without a distinct pair of apical central bristles.. 12.
12. Third visible tergite of abdomen with a dark brown apical fascia, much broader in female than in male, second with or without a paler brown mark of variable extent on centre of apical margin; male tibia without a submedian ventral bristle, female with such a bristle which is shorter than in most other species

except *parviseta* and *australis*; female without any well-developed bristles on each lateral portion of sixth tergite, merely finely haired; third antennal segment of male brownish-yellow, darker in female except at base, and over twice as long as second

inermis, sp. n.

Abdomen without a definite brown apical fascia on third visible tergite; female with one or two long, rather strong bristles on each lateral portion of sixth tergite.....

13.

13. Abdomen with a small black triangular mark on third and fourth visible tergites, and more rarely one on second; ventral bristle on mid-tibia in female with its tip extending almost to apex of tibia; wings in both sexes distinctly clouded on costa beyond middle and on outer cross-vein; antennae yellow, third segment very slightly browned apically in female.....

triangulifera Malloch.

Abdomen entirely yellow; ventral bristle on mid-tibia in female not extending nearly to apex of tibia; wings yellowish hyaline, more noticeably yellow along costa, but without a trace of a greyish cloud beyond middle or on outer cross-vein; antennae yellow, third segment blackish brown except on extreme base on outer and inner sides

parviseta Malloch.

Doddiana nitidiventris (Malloch).

This and the next three species possess, in addition to the long spur-vein at the angle of the fourth vein, a pair of well-developed bristly hairs between the long apical bristles on the scutellum, which are not found in any of the other species, that part of the scutellum being generally bare or furnished with a few very fine microscopic hairs. In one specimen, the type of *flavifrons* Malloch, I find one short bristle present, but the specimen is evidently abnormal, and I have only this one example available.

The large stout build of *nitidiventris* causes it to resemble superficially *sumatrana* of the other group, and to a lesser extent *nigricornis* of the present one, but from both and all other species of the genus it is readily distinguished by the well-developed discal pair of bristles on the second and third visible tergites, a character frequently used by Townsend as a generic one in related groups.

Habitat.—Pahang, F.M.S.

Doddiana nigricornis (Malloch).

Originally described from a female. I have now before me a male which I place here, though it differs from the female in the more extensively blackened disc of the mesonotum and the dark base of the scutellum.

The female has no strong bristles on the divided sixth tergite. This tergite is situated in the apical abdominal cavity, and is divided more or less distinctly into two portions, each of which forms a sort of ridge on each side, between which the apical sternites usually lie. Without dissection it is not possible to determine the exact relations of the various sclerites in this species, although there does appear to be a similar rudimentary seventh tergite, which is longer haired than the sixth, on each side of the apical sternite, and the latter is not as densely short-haired as in most of the other species; there are also some short bristles on the next two preceding sternites. Both sexes possess the well-developed pair of bristles on the centre of apex of the first visible tergite, which are lacking except in *hyalipennis* Malloch in the other group.

Habitat.—Pahang, F.M.S., male, Gunung Singgalang, West Coast of Sumatra, 1000 m., July 1925 (*E. Jacobson*).

Doddiana flavicornis (Malloch).

A much paler-coloured species than the two preceding, the antennæ being entirely yellow, and the thorax and abdomen without dark markings.

It may be pertinent to note here that the hypopygia of the species of the group are all very similar, the fifth sternite being rather deeply cleft, the anterior extremity of the cleft rounded, and each lateral process furnished with a somewhat knob-like elevation on the inner apical angle, from which point the process slopes outward and backward so that it is obliquely transverse at apex. The superior hypopygial forceps are short, and taper to a point, which is sometimes glossy and curved up. There are apparently distinctions in the form of the superior and inferior forceps in the different species, but because of the presence of so many readily available characters for the separation of the species I do not consider

it essential to dissect the few available males to provide supplemental evidence of specific distinctions.

Habitat.—Singapore. An additional male specimen agreeing in all characters with the type from Kuala Lumpur, Selangor, F.M.S., at light, Nov. 3, 1929 (*H. M. Pendlebury*).

The last specimen is the only one recorded on the labels as taken at light, and it may be worth noting that it is one of the palest-coloured in the genus. In some manner the pale colour of many Diptera and nocturnal or crepuscular habits appear to be co-ordinated.

Doddiana punctigera, sp. n.

Male.—A slightly darker species than the foregoing one, with browned wings and the abdomen with deep black markings as noted in the foregoing key to the species. The general habitus is more slender also, and the wings are comparatively longer, the rather definite comb of bristles at apex of the mid-tibia is unique in the genus, so far as I know at present. The frons of the male is narrower than in *flavicornis*, and the hairs on the arista are about as in that species, distinctly longer than its basal diameter, which is longer than the general rule in the genus. The hypopygium is different from that of *flavicornis*. A fuller description appears unnecessary in view of the characterization presented in the specific key.

Length 6.25 mm.

Type, Bettotan, near Sandakan, N. Borneo, Aug. 10, 1927 (*C. Boden Kloss & H. M. Pendlebury*). Deposited in the British Museum through the courtesy of the Federated Malay States Museums, which statement applies equally to all types from the same source in this paper.

Doddiana australis (Malloch).

Some time ago I recorded the receipt of a number of specimens from Australia which I placed as this species, but noted that they had on each side of the abdomen two deep black spots which I had not described as being on the type-specimen. The latter was at that time missing here, but since then I have discovered it, and I find that my description was correct in the omission

of black spots on the abdomen. I am now accepting the form with the spots as a variety which I deal with below.

The type of *australis* is a female. In it the frons at vertex is almost as wide as either eye, the third antennal segment is entirely deep black and about twice as long as the second segment, the mid-tibiae has the ventral bristle not as long as the thickness of the tibia where it is situated, and the sixth tergite has no bristles, nor in fact any distinct hairs on either of the lateral portions.

In this and the following species of the group there is no distinct spur-vein at the preapical angle of the fourth wing-vein, a distinction which would without any doubt be accepted by most specialists in the group as indicative of generic differentiation from those already dealt with above, in which there is a very long well-defined spur-vein present.

Habitat.—Queensland, Australia.

Doddiana australis var. *maculiventris*, nov.

Female.—Similar to *australis* in general habitus and coloration, differing as follows: abdomen with a deep black subtriangular mark on each side of third and fourth tergites, which are visible from both above and below, extreme base of third antennal segment orange-yellow, frons at vertex a little narrower than either eye, and the central stripe with some microscopic black hairs which are not distinguishable in the type of *australis*. Sixth tergite of abdomen as in that species.

Length 7–8 mm.

Type and two paratype females, National Park, N.S.W., 28 & 29. ix. 1922 (Coll. Health Dept., Sydney, N.S.W.); one female paratype, Kenthurst, 3. iv. 1922 (*Gallard*).

I must have returned other specimens to Australia under the name *australis* as I recorded 11, including one male, in my paper in 1930 *.

The male has a pair of strong proclinate outer fronto-orbitals that are not met with in any other species of the genus known to me, and this may not be a feature of typical *australis*, the male of which is yet unknown to me.

I am sending a paratype to the British Museum.

* Proc. Linn. Soc. N.S.W. vol. lv. pt. 2, p. 341.

Doddiana flavifrons (Malloch).

This species and the one immediately following it herein differ from *australis* and all other species in the group without a well-developed spur-vein at angle of fourth in having the second section of the costa not half as long as the first, and the third antennal segment less than 1.5 as long as second. The characters cited in the key should readily distinguish the two species. Both have the ventral bristle on the mid-tibia distinctly longer than the diameter of the tibia, and at least one long bristle on each lateral portion of the sixth abdominal tergite.

Length 6 mm.

Habitat.—Queensland, Australia.

Doddiana pallens Curran.

A paler and more robust species than the next preceding one. The single specimen before me is a female, which I compared with the type-specimen that was sent me by Doctor Walther Horn from Berlin.

Length 7.5 mm.

Habitat.—Queensland, Australia.

Doddiana pahangensis (Malloch).

I have seen only the female type-specimen, which superficially resembles *flavifrons* Malloch, but has the mesonotum with four incomplete black vittæ, the abdomen more extensively black, and the second section of the costa about three-fourths as long as the first. The third antennal segment is deep black, with a mere trace of reddish colour at extreme base on inner side. The middle legs are missing, so that it is impossible to say what length the ventral tibial bristle may be.

Length 6 mm.

Habitat.—Pahang, F.M.S.

Doddiana sumatrana (Malloch).

Originally described from a female; I have three males now before me which differ in colour-markings from the type as noted in the key, and in addition have the apical half of the wings slightly infuscated, a character more evident when the wing is viewed against a white

background. The female has the third antennal segment rather broadly reddish yellow on the outer side at base, and almost all of the inner side of that colour, while the pale colour is less extensive in the male. The mesonotum of the female is brownish yellow and without vittæ, while that of the male is rather darker, and has a rather distinct central blackish vitta on the anterior margin. The first visible tergite of the female is yellow, with the apex narrowly brown, most evidently so below, while the first tergite in the male has the dark apical fascia broader, confined to dorsal surface and extended in a line on centre to the extreme base; the second tergite in the female is entirely glossy blackish brown, both above and below, while in the male it is brownish black only on the apical two-thirds of the dorsum, and has a line extending forward to base in centre of the same colour.

It is possible that there are two species represented by these sexes, but I prefer to leave them as one pending the receipt of more material from the two localities.

Length 9-10 mm.

Habitat of type, Fort de Kock, Sumatra. Males, 3, Fraser's Hill, Pahang, F.M.S., 4200 ft., July 7, 1931 (*H. M. Pendlebury*). Federated Malay States Museums. Both the type and two of the males will be sent to the British Museum, one of the latter being returnable to the Federated Malay States Museums.

Doddiana hyalipennis (Malloch).

Male.—This species is very similar to *triangulifera* Malloch, but the presence of a pair of strong apical central bristles on the first visible tergite of the abdomen, and the lack of a definite cloud on the costa of the wing over the apical section of second vein, and one over the outer cross-vein, prevents me from considering it as that species. I have seen only the type-specimen.

Habitat.—Singapore.

Doddiana inermis, sp. n.

Male and female.—This species is very similar to *parviseta*, differing from it in having the third antennal segment paler, and the abdomen marked with dark brown, as noted in the key to the species. The frons of the male

is wider than the third antennal segment at narrowest part of former, and has no proclinate outer bristle. The ventral bristle on the mid-tibia is lacking on both sides in the male, so that it may be normally thus in that sex, while it is present and of moderate length in the female. The female has the apical sternites of the abdomen densely covered with microscopic fine hairs, and a few short fine hairs on each lateral portion of the sixth tergite. In other respects quite similar to *parviseta*, even to the presence in one specimen of one or two setulæ on the apical section of the first vein.

Length 6-7 mm.

Type, male, Innisfall, N. Queensland; allotype, Cairns, N. Queensland (*F. H. Taylor*); paratype female, Cairns, N. Queensland (*J. F. Illingworth*).

The paratype belongs to the United States National Museum. The type will be sent back to Australia.

Doddiana triangulifera (Malloch).

This species appears to me to best fit the description of *mellea* Wiedemann, but there are some discrepancies that require to be dealt with between the specimens and Wiedemann's description before acceptance can be satisfactory. I have already dealt with the matter herein, so need not go into it further at this time.

Habitat.—Negros, P.I. A male before me now from Ampang Waterworks, Selangor, F.M.S., Aug. 15, 1926 (*C. Dover*).

Doddiana parviseta Malloch.

I have before me only the original type-specimen of this species, which is sufficiently distinguished in the key to insure its identification.

Habitat.—Sydney, N.S.W.

Type to be returned to Australia.

XVI.—Notes on certain Species of the Genus *Orthellia*, with a Description of One new Species. By DAPHNE AUBERTIN, M.Sc., F.L.S.

THE genus *Orthellia* has been clearly defined and partially revised in a valuable paper by Malloch (*Ann. & Mag. Nat. Hist.* (9) xii. pp. 505-519, 1923). An examination of

many of the types of Wiedemann, Macquart, Bigot, Robineau-Desvoidy, and Walker, in the Vienna, Paris, and British Museum collections, shows that some synonymy remains to be established, and that the sense in which certain names have been used must be revised. Some of the synonymy published here is new, and the remainder has been verified in the light of recent work. Types examined by the author are marked with an asterisk.

Orthellia boersiana Big.

**Somomyia boersiana* Big. Ann. Soc. Ent. Fr. (5) vii. p. 37 (1877). (Natal).

**Somomyia caffra* Big. (1877) is a synonym of this species, as is also *Orthellia nigrohatterata* Stn. (1913), as determined by Malloch. It appears to be very closely allied to **O. viridifrons* Macq. (*siamensis* Mall.); I can see no difference between the males of the species, but in the females the distance between the eyes is less in *O. boersiana* Big. than in *O. viridifrons* Macq., and the parafrontals are narrower and more shiny; these differences, however, are slight and of degree only. An examination of the male genitalia might reveal further differences.

Orthellia caesarion Mg.

Musca caesarion Mg. S. B. v. p. 57 (1826). (Europe.)

The following names are synonyms :—

- **Musca puella* Mg. (1826).
- **Lucilia carolinensis* R.-D. (1830).
- **Lucilia chloris* Hol. (1833).
- **Musca herosa* Walk. (1849).
- **Musca connexa* Walk. (1852).
- **Somomyia argentifera* Big. (1877).

Orthellia chalybea Wied.

Musca chalybea Wied. Ausser. Zweifl. Ins. ii. p. 402 (1830). (Java.)

The following names are synonyms :—

- Pyrellia violacea* Macq. (1851).
- **Musca gavia* Walk. (1860).
- **Somomyia nitidifacies* Big. (1887).

Orthellia caerulea Wied.

**Musca caerulea* Wied. Zool. Mag. iii. p. 23 (1819). (Java.)

The following names are synonyms :—

**Orthellia timorensis* R.-D. (1830).

? *Lucilia philippensis* Macq. (1843).

**Lucilia caeruleifrons* Macq., nec Malloch, part. (1851).

**Lucilia viridiceps* Macq. (1853).

**Musca obtrusa* Walk. (1859).

**Musca benedicta* Walk. (1859).

**Musca intrahens* Walk. (1860).

**Pyrellia porphyricola* Walk. (1864).

**Somomyia atrifacies* Big. (1877).

Orthellia diffidens Mall., nec Walk. (1923).

Malloch (1923) suggests that *Lucidia viridiceps* Macq. is a synonym of *O. lauta* Wied., but it seems to me to be identical with this species. *Lucilia viridifrons* Macq. is a good species.

Orthellia diffidens Walk.

**Musca diffidens* Walk., nec Malloch, Journ. Proc. Linn. Soc. i. p. 26 (1857). (Singapore.)

The following names are synonyms :—

**Musca reflexa* Walk. (1857).

**Musca perflxa* Walk. (1857).

**Musca optata* Walk. (1860).

Orthellia caeruleifrons Mall., nec Macq. (1923).

Orthellia indica R.-D.

**Lucilia indica* R.-D. 'Myodaires,' p. 453 (1830). (India.)

Synonyms of this species are **O. obscuripes* Stn. (1918) and *O. latifrons* Mall. (1923). The female cotypes of **O. viridifrons* Macq. also belong here.

Orthellia lauta Wied.

**Musca lauta* Wied. Ausser. Zweifl. Ins. ii. p. 410 (1830)†. (Java.)

The following species are synonyms :—

**Lucilia bengalensis* R.-D. (1830).

**Lucilia eximia* R.-D., neo Wied. (1830).

† The question of priority arises in connection with Wiedemann and Robineau-Desvoidy names of 1830, published respectively in 'Ausser-europäische zweiflügelige Insekten,' vol. ii., and 'Essai sur les Myodaires, Mémoires présentés à l'Académie Royale des Sciences de l'Institut de France,' vol. ii. According to Mr. C. D. Sherborn there is no contemporary evidence of the month in which either of these works appeared, but the former was reviewed in 'Isis' in June 1831, while the latter was not reviewed in the same periodical until the following November. In the absence of conclusive evidence, it would appear reasonable to assume that the order in which the works were noticed in 'Isis' indicates the order in which they were published. Wiedemann's names are therefore given priority in this paper.

**Musca proerna* Walk. (1849).

**Musca polita* Walk. (1856).

Stein (Arch. Naturg. lxxxiii. p. 105, 1917) gives **Lucilia cyaneo-marginata* Macq. as a synonym of this species, whereas it is actually a synonym of **Lucilia papuensis* Macq. (*metilia* Walk.).

Orthellia maronea Walk.

**Musca maronea* Walk. List Dipt. Brit. Mus. iv. p. 886 (1849). (Australia.)

**Musca donysa* Walk. (1849) is a synonym of this species, and there can be little doubt that it is also identical with *Pyrellia nigriceps* Macq. (1850). Both Walker's types run to this species in Malloch's key (1923), and agree perfectly in the further characters which he gives in the text (p. 514).

Orthellia nigrocincta Big.

Pyrellia nigrocincta Big. Arch. Ent. ii. p. 370 (1858). (Africa.)

Stein (1917) suggested that this species and the one described by him under the name *O. albigena* (1913) were identical; Malloch (Ann. & Mag. Nat. Hist. (9) xvi. p. 365, 1925) accepts the idea.

I have seen several specimens, the property of the Indian Museum, collected at Ootacamund, which closely resemble this species, but the differences appear to be of more than varietal value; I therefore propose to describe it as a new species.

Orthellia steini, sp. n.

♂♀.—*Head*. Eyes separated, in male by twice width of third antennal segment, in female by one-third total head-width, sparsely short-haired in male and microscopically haired in female; frons black, parallel-sided; parafrontals in male narrow, metallic towards vertex, covered with silver tomentum anteriorly and bearing a row of fine frontal bristles; in female each parafrontal equal in width to that of frons, metallic-coloured on upper two-thirds, silver-dusted anteriorly, bearing a row of fine frontal bristles and a single fine inwardly directed fronto-orbital bristle; parafacials covered with silver tomentum; jowls shining blue-green; palpi and antennae dark brown to black.

Thorax. Shining green to purple; dorso-centrals 2+3

(all well developed); a pair of prescutellar acrostichals present.

Abdomen. Shining green to purple, equal in length, or slightly longer than thorax.

Wings. Hyaline; fourth vein rounded in an obtuse angle; squama testaceous in male, white in female; halteres dull orange.

Legs. Black; femora partly metallic in colouring.

Types ♂ and ♀, and 4 ♀ paratypes; India, Madras, Ootacamund, Nilgiri Hills, 7500 ft. (*Fletcher*).

The male and female and one paratype in British Museum; remaining paratypes in Indian Museum.

This species differs from *O. nigrocincta* Big. in that the eyes are more hairy, the parafrontals in the male rather less metallic in colouring, there is no patch of silver tomentum on the anterior margin of the thorax, and the squama is testaceous in the male, dirty white in the female, whereas in *O. nigrocincta* it is gleaming white in both sexes.

Orthellia peronii R.-D.

**Lucilia peronii* R.-D. 'Myodaires,' p. 460 (1830). (S. Africa.)

The following species are synonyms:—

**Musca cyanea* of Widemann, Macquart, Steen, and Malloch, *nec* Fabricius.

**Musca sarcina* Walk. (1849).

**Musca phara* Walk. (1849).

**Musca mazaca* Walk. (1849).

**Musca bræsia* Walk. (1849).

**Lucilia rectineervis* Macq. (1855), part.

The type of *O. peronii* R.-D., in the Paris Museum, bears a locality-label "Timor," but it is undoubtedly the common S. African species long known as *O. cyanea* F. Stein (1917) places *Cosmina diademata* Big. (1878) here.

Orthellia racilia Walk.

Musca racilia Walk. List. Dipt. Brit. Mus. iv. p. 884 (1849). (W. Africa, Sierra Leone.)

Type, a unique male specimen in fairly good condition.

Redescription. Eyes very shortly and sparsely haired, almost bare; separated in male by width of third antennal segment; parafrontal contiguous, rather shining; para-facials black, slightly covered with silver tomentum; jowls shining metallic-coloured; antennæ and palpi dark brown to black.

Thorax. Shining green; dc. 2+3-4 (the anterior bristles very short), a pair of extra prescutellar bristles between the acrostichal and posterior dorso-central bristles.

Abdomen. Shining blue-green.

Wings with a faint brown cloud anteriorly, hyaline posteriorly; squama pale brown; halteres dark brown.

Legs. Black.

Orthellia sperata Walk.

**Musca sperata* Walk. Journ. Proc. Linn. Soc. iv. p. 136 (1860). (Celebes.)

**Musca electa* Walk. (1860) is a synonym of this species, and it is very probable that *Orthellia trispina* Mall. (1928) will also prove to be one.

In the British Museum there are four male specimens, three from Celebes and one from Borneo; they agree perfectly in chaetotaxy with that ascribed by Malloch for a female of *O. trispina*. The eyes in these specimens are separated from one another by a distance equal to half the width of third antennal segment; the facets are small and uniform.

Orthellia viridifrons Macq.

**Lucilia viridifrons* Macq., part., ♂, Dipt. Exot. ii. pt. 3, p. 295 (1843). (Mauritius.)

The following names are synonyms:—

**Lucilia caeruleifrons* Macq., nec Malloch, part. (1851).

**Musca trita* Walk. (1857).

**Orthellia siamensis* Mall. (1923).

The cotypes of this species comprise two males and two females; the females, however, belong to *Orthellia indica* R.-D.

**Lucilia flavicalyptrata* Macq. (1848) runs to *O. siamensis* Mall. in this author's key (1923); the eyes in the male, however, seem to approach one another more closely, the facets in the upper half of the eye are rather smaller, and the halteres are brighter yellow than is usual in *O. viridifrons* Macq. The type is a unique male, so that it would be advisable to examine more material before deciding whether or not it represents a good species.

British Museum (Natural History),
South Kensington.

XVII.—A few new Melolonthine Coleoptera from Mexico.

By GILBERT J. ARROW.

THE species here described were contained in a rather large collection sent to me for identification by Dr. Alfons Dampf, Head of the Research Department of the Mexican Agricultural Secretariate. They were collected in various parts of Mexico, chiefly by Dr. Dampf himself between June 1929 and June 1931, but some were taken by L. Conradt at earlier dates. By kind permission of Dr. Dampf the types remain in the British Museum collection; co-types will be found in the Entomological Laboratory of the Agricultural Secretariate, San Jacinto, Mexico.

Chlænobia colimana, sp. n.

Omnino pallide flava, lævis, nitida, angustissima, capite sat crebre punctato, clypei margine haud exciso; pronoto haud brevissimo, minute sat parce punctato, lateribus medio angulatis, antice et postice valde convergentibus, basi angustato; elytris minute parum crebre punctatis, costa suturali sed discoidalibus nullis:

♂, tibiis anticis bidentatis, posticis versus apicem longe et dense hirsutis, harum calcaribus brevibus, tarsis omnibus longis, dilatatis, subtus dense vestitis; metasterni medio breviter dense setoso, abdomine subtus arcuato, segmento sexto longo, longe ciliato, margine antice valde rotundato, pygidio angusto, longo, nitido, modice punctato:

♀, pedibus brevioribus, tibiis anticis tridentatis, posticis apice dilatatis, calcaribus longis; corpore subtus fere nudo, pygidio longo, fere verticali, profunde excavato, parte excavata longitudinaliter profunde et anguste sulcata, parte basali porrecto, fere acuminato.

Long. 13.5–16 mm., lat. max. 6–7.5 mm.

MEXICO: Colima (*L. Conradt*).

This is a moderately large form with the same coloration and general aspect as *C. angustata*, *ægrotæ*, and other species. It differs in the extreme smoothness of the pronotum and elytra, the uniformly rounded and entire clypeal margin, and the narrowness of the pronotum at the base. The terminal part of the abdomen is very highly developed in both sexes. In the male the last sternite is very large and produced forward in the middle. In the female the pygidium is of very peculiar shape; it is very long and narrow, broadest at the base, where

it is very prominent and almost acuminate, and from the peak to the extremity it is deeply hollowed, with a deep longitudinal groove along the middle of the hollowed part, which is coarsely punctured, while the prominent basal part is finely punctured and very shining.

The type-species of *Chlanobia* is *C. ciliatipes* Bl. (found in Brazil, according to Lacordaire), and eight Central American species were added by Bates. These latter, as well as that described here, have ten joints to the antennæ, whereas Blanchard and Lacordaire agree in assigning nine only to *C. ciliatipes*.

Listrochelus crista-galli, sp. n.

Fusco-rufus, capite pronotoque piceis, nitidis, clytris pruinosis, pectore dense flavo-villoso pedibusque flavo-hirtis: subcylindricus, angustus, elongatus, capite minute sat crebre punctato, clypeo dense et rugose punctato, margine antico vix exciso, pronoto minute sat crebre punctato, lateribus post medium fortiter angulatis, antice et postice fere rectis, angulis omnibus obtusis; scutello minute punctato; elytris minutissime sat crebre punctatis, costa juxta-suturali præditis:

♂, tibiis posticis intus dense villosis, tarsorum posticorum articulo primo penicillato, unguibus haud dentatis, subtus pectinatis, pygidio convexissimo, abdominis medio longitudinaliter cristato, segmentis 4 basalibus crista quadri-lobata laminatis, segmentoque sexto stylo retrorsum directo, setoso, armato:

♀, unguibus pectinatis, ante medium dentatis (pedum posticorum interno excepto), abdomine subtus convexissimo, basi longitudinaliter impresso, pygidio late longitudinaliter excavato.

Long. 17-20 mm.; lat. max. 8-10 mm.

MEXICO: Valle Yaqui, Sonora (*A. Dampf*, Aug.).

This is a rather large and narrow-bodied species, with a considerable resemblance to *L. mucoreus* Lec., and having, like that, a dark shining pronotum and paler elytra with a greyish bloom. The remarkable sexual characters immediately distinguish it from all other known species. The male bears upon the four basal sternites a longitudinal keel or crest, suggestive of a cock's comb, with a lobe corresponding to each segment. The basal lobe is blunt, the others sharp, the fourth almost horizontal in position and having just beneath it another

slight process from the fifth sternite; the sixth also bears a strong process directed obliquely backward. The pygidium of the male is very tumid, smooth and shining except at the base, the hind tibia is densely hairy on its inner face, the first tarsal joint of the same pair of legs is tufted, and the claws are pectinate and not toothed. In the female the claws are more finely pectinate and each has a strong tooth before the middle with the exception of the inner hind claw; in this sex the pygidium has a deep and wide longitudinal groove and the abdomen is finely grooved at the base beneath. The antennal club of the male is equal in length to the remaining joints exclusive of the scape.

Listrochelus debilis, sp. n.

Læte fulvus, capite pronotoque rufescentibus, corpore nitido, sterno parum dense aut longe villosa, capite minute punctato, vix carinato, clypei margine antico medio leviter sinuato; pronoto minute inæqualiter punctato, lateribus antice convergentibus; elytris minute irregulariter punctatis, costarum discoidalium vestigiis duabus; unguibus basi minute serratis, haud dentatis:

♂, capite sat parce punctato, margine antico vix exciso, pronoto lateribus postice rotundatis, angulis posticis nullis, pygidio lævi, vix punctato, abdomine subtus leviter excavato:

♀, capite, pronoto tibiisque læte rufis, capite crebre punctato, margine antico fortius exciso, crebre punctato, lateribus postice haud rotundatis, pygidio sat fortiter et crebre punctato, pedibus brevioribus.

Long. 10-12 mm.; lat. max. 4-6 mm.

Mexico: Valle Yaqui, Sonora (*A. Dampf*, Aug.).

Although the two sexes differ considerably I think there can be little doubt that I have rightly associated them, the two forms occurring at the same time and place. Three specimens are males and five females; the former are lighter in colour and less strongly punctured upon the head, pronotum, and pygidium.

The species is a small and narrow one, without distinct carinae upon the head, which is sparingly punctured in the male and densely in the female, the clypeus feebly excised in the former and very distinctly in the latter. The pronotum is not very closely punctured in the male, very closely upon the anterior part in the female, and the hind angles are visible, though very obtuse, in the female

and quite obsolete in the male. Discoidal costæ are distinctly visible upon the elytra of the male and less distinctly in the female, and the pygidium is feebly punctured in the former and strongly in the latter. The legs, as usual, are much more slender in the male, but the claws are similar in both sexes, serrate beneath, but without a tooth.

Lachnosterna dampfi, sp. n.

Rufo-brunnea, nitida, glabra, capite nigro, metasterno dense parum longe griseo-hirto; robusta, sat lata, clypeo brevi, crebre punctato, nitido, margine fortiter reflexo, medio minutissime exciso, fronte dense punctato-rugoso; pronoto modice sat æqualiter punctato, lateribus medio obtuse angulatis, antice et postice fere rectis, vix crenatis, angulis anticis obtusis, posticis rectis, scutello fortiter punctato; elytris minus nitidis, crebre punctato-rugosis, costa suturali haud lata, aliis obsoletis; pygidio leviter sat parce punctato; antennis 10-articulatis:

♂, clava antennali sat longa, tarsis gracilibus, unguibus ante medium fortiter dentatis, tibiæ posticæ calcaribus articulatis, haud acutis, majori valde arcuato, abdominis medio planato, fere lævi.

Long. 22-23 mm.; lat. max. 11-12 mm.

MEXICO: G. Rodriguez, Nuevo Leon (*A. Dampf*, June).

A series of eight specimens are all males.

This large and well-marked species has the general appearance of *L. schizorhina* Bates, but is reddish-chestnut in colour, with the elytra much more closely and finely sculptured, and without distinct costæ except at the sutural margin. The clypeus is very feebly indented in the middle. The male will be easily recognized by the peculiar form of the larger spur of the hind tibia. Both spurs are short and very blunt, and the larger one is bulbous at the base, which is set in a deep excision of the terminal margin of the tibia, and the projecting part is very strongly curved, forming a strong, almost semicircular, hook. The only other species, so far as I know, in which such a structure has been found is the North American *L. hamata* Horn, a much smaller insect, in which the corresponding spur is less strongly curved.

Lachnosterna microcerus, sp. n.

Lachnosterna cribricollis Bates, Biol. Centr.-Amer., Col. ii. 2, 1888, p. 180, pl. x. fig. 23.

Læte rufo-castanea, nitida, corpore subtus pygidioque pallidis, pectore dense flavo-villoso; elongato-ovali, capite toto rugoso, erecte setoso, clypeo fortiter sinuato, pronoto fortiter sparse punctato, punctis piliferis, lateribus medio valde angulatis, angulis anticis acute productis; elytris leviter et minute punctatis, costa suturali distincta, pygidio nitido, modice punctato et piloso; utriusque sexus abdomine subtus convexo clavaque antennali brevissima:

♂, abdomine subtus vix sulcato, segmento ultimo planato et dense rugoso:

♀, abdomine subtus toto convexo, nitido.

Long. 15-17 mm.; lat. max. 8-9 mm.

MEXICO: Cuernavaca (*L. Conradt*, Aug.; *H. H. Smith*, June). Hidalgo, Guerrero, 9000 ft. (*Mann & Skewes*). Guanajuato.

This species was described and figured by Bates as *Ancylonycha cribricollis* Blanch., but he confused with it a specimen of another species which I believe to be the true *cribricollis*, and of which the British Museum contains another specimen, probably a co-type, so labelled by Blanchard himself. Blanchard's name, however, was invalid, having been previously used for an Indian insect by Redtenbacher. It will be convenient therefore to rename both species. The specimen described by Bates as the female of *L. cribricollis* was brought from Guatemala and represents yet another species.

Lachnosterna blanchardi, sp. n.

Ancylonycha cribricollis Bl., Cat. Coll. Mus. Paris, 1851, p. 133.

Testacea, capite pronotoque rufis, pectore dense flavo-villoso; elongato-ovata, capite rugoso, erecte setoso, clypeo fortiter sinuato; pronoto fortiter sparse punctato, punctis piliferis, angulis anticis haud productis; elytris nitidis, lævissime punctatis; pygidio parce et minute punctato, breviter inconspicue setoso:

♂, antennarum clava stipite paulo longiori, abdominis medio sulcato, segmento ultimo planato et rugoso, precedentibus nitidis, utrinque rotundato-elevatis:

♀, clava antennali tarsisque brevibus, abdomine toto nitido, medio leviter sulcato.

Long. 13-14 mm.; lat. max. 7-9 mm.

MEXICO: San Luis Potosi; San Jacinto, D.F. (*A. Dampf*, May-July).

The two species are much alike, but *L. blanchardi* has blunter front angles to the thorax than *L. microcerus*, in which they are very sharply produced, paler and smoother elytra, the punctures of which are very minute, as they are also upon the pygidium. The very fine, pale, and inconspicuous hairy clothing of the latter was overlooked by Blanchard. In the male the two species are easily distinguished. *L. microcerus* has the club of the antenna extremely short, the abdomen very tumid beneath and scarcely at all channelled along the middle line. *L. blanchardi* has a moderately long antennal club and the abdomen is deeply channelled, with a row of four slight rounded swellings on each side of the channel. In both species the terminal sternite is flattened and opaque. *L. verruciventrīs* Moser, also Mexican, is evidently closely similar to *L. blanchardi*, but has the pygidium closely instead of sparsely punctured.

Thyce squamicollis Lec.

The genus *Thyce* has not been previously recorded from Central America, *T. squamicollis* having been known hitherto as inhabiting Texas and New Mexico. It appears to me a little doubtful whether the other species at present placed in the genus are truly congeneric with this, the type-species. They differ markedly from it in form and in the structure of the front tibiae.

The genus has an obvious resemblance to *Cyphonotus* and certain allied genera of Central Asia and Eastern Europe, which have a many-jointed club to the antenna, and in the Central American fauna is most nearly related to the genus *Polyphylla*, in which also the club is many-jointed. The close resemblance to the Old-World genera is possibly due to a great extent to convergence produced by similar conditions of life. Probably all inhabit dry sandy localities and are nocturnal in their habits, burrowing freely into the sandy ground and remaining hidden there during the daytime. *Thyce squamicollis* was taken at light near Ciudad Juarez on the banks of the Rio Bravo, which forms the boundary between Mexico and the United States. It will be immediately recognized by its long parallel-sided form,

the stout front and hind legs, the front tibiae having the usual sharp teeth replaced by very blunt rounded prominences. The middle legs are slender and their tarsi nearly half as long again as those of the hind legs.

XVIII.—*Some Amphibians and Reptiles from the Lesser Antilles.* By H. W. PARKER, B.A.

(Published by permission of the Trustees of the British Museum.)

DURING the past two years the British Museum has received, through the co-operation of the officers of the Atlantic Fleet, a series of collections from the British West Indies. The herpetological material, reported upon here, has proved of considerable interest, particularly by reason of the light it sheds on the relationships of forms previously very imperfectly known and as showing the persistence of species which were believed to have been exterminated by the mongoose. The author wishes to acknowledge his indebtedness not only to the gentlemen to whom specimens are ascribed below, but to the many residents in the islands who, directly or indirectly, assisted so much in the making of the collections.

1. *Eleutherodactylus martinicensis* (Tschudi).

Barbour (1914, pp. 248-9, and 1930, p. 77) maintains that there are two species of *Eleutherodactylus* in the Lesser Antilles, a northern and central form (*E. martinicensis*) and a southern form confined to Grenada and possibly Barbados and St. Vincent (*E. johnstonei*). The southern form is said to differ from its northern congener in having a larger tympanum ($\frac{1}{2}$ vice $\frac{1}{3}$ eye) set closer to the eye, shorter hind limbs, and a greater stature. But it is becoming increasingly doubtful whether these differences indicate the existence of two species. Specimens from St. Kitts, an island whose *Eleutherodactylus* Barbour was unable to differentiate from *martinicensis*, are indistinguishable from examples from Grenada identified by its describer as *E. johnstonei*; conversely other specimens from Grenada have a small tympanum ($\frac{1}{3}$ eye) separated from the eye by a distance equal to its diameter, and a hind limb so

long that the tibio-tarsal articulation reaches halfway between the eye and the nostril. This might be taken to indicate that the two species are now more widely distributed than is generally recognized; but it is more probable that there is but a single rather variable species. In a series from Guadeloupe the tympanum is found to be distinctly variable in size, measuring nearly half the ocular diameter in some half-grown examples, but only about one-third this amount in adults. Distance from the eye is correlated with tympanic size, the distance measuring only about three-fifths the diameter of the tympanum in immature specimens, but being approximately equal to it in adults. Leg-length is also variable, for in the same series the tibio-tarsal articulation may reach anywhere between the tympanum and the anterior border of the eye. Maximum size is of no account, for specimens larger than the biggest *johnstonei* have been seen from Dominica, Martinique, and Guadeloupe.

The British Museum now has representatives of this species from St. Eustatius, St. Kitts, Nevis, Antigua, Montserrat, Guadeloupe, Dominica, Martinique, Sta. Lucia, St. Vincent, Barbados, and Grenada.

2. *Sphaerodactylus elegantulus* Barbour.

Juv. Five Islands Bay, Antigua (*Lt. Mansell*).

♀. Sta. Lucia (*Lt.-Comdr. Rodger*).

From what is known of the distribution of the species of *Sphaerodactylus* in the West Indies the determination of the second of the above specimens seems doubtful; but it is certainly not the normal Sta. Lucia species (*S. microlepis*), and comparison with six specimens from Antigua reveals only trivial differences. There can be little doubt of the correctness of the locality, for the specimen was collected in 1931, in which year no reptiles were obtained on Antigua by either collector. The only possible conclusions appear to be either that *elegantulus* has been recently introduced into Sta. Lucia or that this island harbours two species, *S. microlepis* and one very similar to *S. elegantulus*.

3. *Sphaerodactylus microlepis* Reinh. & Lützk.

♂ ♀. Anse La Raye District, Sta. Lucia (*Lt. Mansell*).

4. *Sphærodactylus pictus* Garman.

♀. St. Kitts (*Lt. Mansell*).

5. *Hemidactylus mabouia* (Moreau de Jonnés).

♂, 4 yg. Montserrat (*Lt. Mansell*).

♀. Antigua (*Lt. Mansell*).

Three of the juveniles were collected as eggs, which hatched subsequently. It was observed in one instance that the hatching process took about two hours and the egg-tooth was shed within an hour after the emergence of the young gecko.

6. *Thecadactylus rapicaudus* (Houtt.).

5 ♂♂ and ♀♀. Montserrat (*Lt. Mansell*).

7. *Anolis luciae* Garman.

6 ♂♂, ♀♀, and hgr. Anse la Raye distr., Sta. Lucia (*Lt. Mansell*).

8. *Anolis vincenti* Garman.

13 ♂♂, ♀♀, and yg. St. Vincent (*Capt. Totton*).

Captain Totton reports that this species is still abundant in and around the "Old Fruit and Vegetable Bureau."

9. *Anolis æneus* Gray.

3 ♂♂. Turner Hall Wood, Barbados (*Lt.-Commr. Rodger*).

3 ♂♂. Bridgetown, Barbados (*Lt. Mansell*).

10. *Anolis antiquæ* Barbour.

♂ ♀. Five Islands Bay, Antigua (*Lt. Mansell*).

11 ♂♂, ♀♀, and yg. Near St. Johns, Antigua (*Capt. Totton*).

11. *Anolis watsi* Boulenger.

21 ♂♂, ♀♀, and yg. Near St. Johns, Antigua (*Capt. Totton*).

2 yg. Five Islands Bay, Antigua (*Lt. Mansell*).

♂ and ♀. Nevis (*Lt.-Commr. Rodger*).

12. *Anolis lividus* Garman.

2 ♂♂, 2 yg. Montserrat (*Lt. Mansell*).

13. *Anolis bimaculatus* Sparrman.2 ♂♂, 3 ♀♀. Nevis (*Lt.-Commdr. Rodger*).14. *Anolis gingivinus* Cope.♂, hgr. Anguilla (*Lt.-Commdr. Rodger*).15. *Ameiva fuscata* Garman.♂. Dominica (*Lt.-Commdr. Rodger*).16. *Ameiva griswoldi* Barbour.♂. Custom's House Yard, Antigua (*Lt. Mansell*).17. *Ameiva garmani* Barbour.♀. Anguilla (*Lt.-Commdr. Rodger*).18. *Gymnophthalmus pleii* Bocourt.Juv. Sta. Lucia (*coll. I. Frew*).

The discovery of even such a tiny specimen as this (it measures only 19 mm. from snout to vent) is sufficient to show that the species is not, as was generally believed, quite extinct; but it must be exceedingly rare, as Mr. Frew has never seen another specimen. An additional interest attaches to this example, for over a short distance at the middle of the body there are only 15 scale-rows, as in the specimen described by Bocourt as *G. luetkeni*; but in other respects it agrees with normal individuals of *G. pleii*, and so tends to confirm the supposition that these two names are synonyms.

19. *Typhlops jamaicensis* (Shaw).2. Montserrat (*Lt. Mansell*).

During recent years there has been a tendency among certain herpetologists to regard the blind-snake of each West Indian island as specifically, or at least racially, distinct from its relatives on neighbouring islands. This has been particularly evident among the *jamaicensis* group of forms, which are characterized by 22 scale-rows round the anterior part of the body and which have hitherto been recorded from Jamaica, Porto Rico, Virgin Islands, St. Kitts, Antigua, Montserrat, Martinique (?), and Barbados (?). No specimens from St. Kitts have been examined, the Martinique

record is exceedingly doubtful, and the example alleged to have come from Barbados (Boulenger, 1893, p. 31) proves to belong to *T. pusillus* * Barbour and can be eliminated from consideration. The following table (including records by Cochran, 1924, and Schmidt, 1928) shows the known range of variation in the number of scales from the head to the tip of the tail, which is the character mainly used in differentiating the various forms :—

Island.	Name available.	Vertebral scales.	No. of specimens.	Range of variation.
Jamaica.	<i>T. jamaicensis</i> (Shaw).	405–425	5	20
Porto Rico.	<i>T. platycephalus</i> Dum. & Bibr.	365–420	25	55
Montserrat.	.....	370–397	5	27
St. Thomas.	<i>T. richardii</i> Dum. & Bibr.	315–365	11	50
Antigua.	.....	346–368	5	22

It is thus apparent that the available series are entirely inadequate and that the known range of variation rises rapidly with increase in the number of specimens examined. There can be little doubt that the average scale-count for the form of each island will be found to be slightly different; but the range of variation in each island overlaps that of other islands to such an extent that until these averages are thoroughly established it is, perhaps, more convenient to call the whole group *T. jamaicensis*, and, if greater precision is needed, specify the island where the animal was found. At present, if bi- or trinomials were to be associated with recognizable morphological characters and not with hypothetical differences inferred from distributional data, the Montserrat race (with 370–397 vertebrales) would have to bear the same name as that from Porto Rico (with 365–420) and the Antigua form (with 346–368) as that from St. Thomas (with 315–365).

20. *Alsophis leucomelas* (Dum. & Bibr.).

Snakes referable to this species, or to forms closely allied to it, have been recorded from Dominica, Guade-

* A misprint appears to have crept into the original description of this species, where it is stated that the number of scales on the mid-ventral line from chin to vent is "about 370"; in four specimens examined, including a topotype, there are 272, 273, 275, and 281. There may also be 22 scale-rows.

loupe, Montserrat, Antigua, Marie Galante, and the Iles des Saintes, but herpetologists have disagreed as to the status to be accorded to the various local races. Critical examination of the material in the British Museum suggests that four or five forms are recognizable by morphological and colour differences. These differences appear to be of about the same degree of magnitude as those which, on a continental land-mass, are usually associated with subspecies; but whereas the latter are linked one with another geographically, the links being intermediate in character as well as position, the island-forms are geographically isolated and no such links can exist. That such a difference necessitates the recognition of the insular forms as distinct species, as some herpetologists insist, seems entirely illogical. In the present instance, too, it so happens that the snakes of Montserrat are exactly intermediate (almost uncannily so) between those of Dominica and Guadeloupe, so that the three form a connected series and consequently cannot be accorded more than subspecific status. The five forms are :—

A. *Alsophis leucomelas leucomelas* (Dum. & Bibr.).

Distribution.—Guadeloupe and Marie Galante.

Diagnosis.—Scale formula 19—19—15; ventrals 191—208; subcaudals, ♀ circa 115—123+1, ♂ circa 140—144+1. Colour-pattern consisting of a mid-dorsal and a pair of lateral dark lines in the young; in adults this dark colour spreads to cover all the dorsum and venter posteriorly, but anteriorly the light ground persists on the venter and as a double alternating series of yellow blotches on the back and further smaller irregular spots on the flanks. Some examples are entirely black.

Six specimens have been examined, two females and four males; unfortunately the tip of the tail is so frequently injured that the exact subcaudal counts cannot be determined.

B. *Alsophis leucomelas sanctorum* Barbour.

Distribution.—Isles des Saintes, near Guadeloupe.

Diagnosis.—Ventrals 195—206; subcaudals 128—139. Light reddish to greyish, with a dark stripe through the eye to the sides of the neck, and, sometimes, a dark vertebral line.

No specimens have been examined. Dr. Barbour reports that the tail is, as in the preceding form, frequently imperfect, but it seems probable that the subcaudal count will prove to be about as high as in the typical form.

C. Alsophis leucomelas sibonius Cope.

Distribution.—Dominica.

Diagnosis.—Scale-formula 19—19—17; ventrals 191—201; subcaudals, ♀ 112—115+1, ♂ 112—122+1. Colour-pattern in juveniles consisting of an undulating dark vertebral stripe, a narrow lateral line, and dark spots on the flanks and hinder part of the belly. In adults the posterior part of the body is almost entirely black, but anteriorly the dorsal stripe is broken up into a series of large oval spots narrowly separated from one another; the light interspaces may be fused on the sides of the neck to form a fairly distinct light stripe.

Eleven specimens examined, seven females and four males. This form is readily distinguished from the typical form by the higher number of scales in front of the vent and the lower number of subcaudals in the male.

D. Alsophis leucomelus manselli, subsp. n.

Distribution.—Montserrat.

Diagnosis.—Scale-formula usually 19—19—16, sometimes 19—19—15 or 19—19—17, rarely 19—21—17. Ventrals 198—208; subcaudals, ♀ 115—123+1, ♂ 126—134+1. Colour-pattern of the juvenile a broad dark mid-dorsal stripe (sometimes replaced by three narrower ones), a narrow dark lateral stripe, and some dark dots on the flanks and belly.

In adults the dark pigment becomes more pronounced, but the mid-dorsal stripe is fenestrated anteriorly by a double alternating series of yellow spots; the light dorso-lateral lines (between the dark dorsal and lateral stripes of the juvenile) persist over almost the whole of the body and tail.

Cotypes:

♂, 3 ♀♀, juv. ♂, juv. ♀, number B.M. 1931.10.18. 179—184 (coll. Mr. Gomez). Scales 19—19—16; ventrals 200, 198, 200, 203, 208, 202; subcaudals 134, 126, ♀, 123, 131, 118+1.

♂, number B.M. 1932.4.1.33 (coll. Lt. Mansell). Scales 19—19—15; ventrals 204; subcaudals 132+1.

2 ♂♂, 4 ♀♀, number B.M. 86.10.16.3-8 (coll. Mr. Hollings). Scales 19—19—17, 19—19—16, 19—21—17, 19—19—17, 19—19—16, 19—19—15; ventrals 198, 206, 204, 198, 202; subcaudals 126, 131, 122, ?, 115, 117+1.

♀, number B.M. 99.6.29.18 (coll. Dr. Gregory). Scales 19—19—16; ventrals 206; caudals 122+1.

The normal scale-formula of this race is exactly intermediate between that of *leucomelas* and *sibonius*, but occasionally specimens are found agreeing with one or the other; the subcaudal count of the male too is intermediate, but the persistence of a light dorso-lateral streak on the hinder part of the body and tail distinguishes it at once from either of its relatives.

E. Alsophis leucomelas antiquæ, subsp. n.

Distribution.—Antigua.

Diagnosis.—Scale-formula 19—19—17; ventrals 195-200; subcaudals, ♀ 102-103, ♂ ? Colour-pattern of the juveniles, a dark lateral stripe through the eye along the sides of the body and tail and a zig-zag dorsal stripe; anteriorly the dorsal stripe touches the laterals and on the neck it is broken up into transverse bars connecting the lateral stripes. Adult not known.

Cotypes: two juveniles, numbers B.M. 50.4.29.1-2 (coll. Mr. Gardiner).

No specimens of this race appear to have been collected in recent years, and it may well prove to be extinct; but although it is so imperfectly known the low subcaudal count readily distinguishes it.

21. *Dromicus juliae* Cope.

2 ♀♀, v. 159, 162; c. 80, 79+1, Dominica (Lt.-Commr. Rodger).

REFERENCES.

- BARBOUR, T. 1914. Mem. Mus. Comp. Zool., Harvard, xliv. 2, pp. 209-246.
 —. 1930. 'Zoologica,' New York, xi. 4, pp. 61-116.
 BOULENGER, G. A. 1893. Cat. Snakes Brit. Mus. i.
 COCHRAN, D. M. 1924. Journ. Wash. Acad. Sci. xiv. 8, pp. 174-177.
 SCHMIDT, K. P. 1928. New York Acad. Sci. x.

XIX.—On the Decapod Crustacean *Æger lævis* (Blake).

By THOMAS H. WITHERS, F.G.S., of the British Museum (Nat. Hist.).

[Plato IV. figs. 1–3.]

Mr. L. BAIRSTOW, of the Geological Department of the British Museum, has recently collected and presented to that Department a Decapod Crustacean from the Lower Lias of Robin Hood's Bay, Yorkshire. This specimen, which is very well preserved, undoubtedly belongs to the species *Æger lævis* (Blake), and careful development of it has exposed the telson, till now unknown. The grooves on the carapace and the form of the abdominal segments are much better shown than in the specimens figured by Woods (1925, pl. i. figs. 3–5).

A comparison with the five specimens of *Æ. lævis* in the British Museum, four (nos. 45109 (Woods, 1925, pl. i. fig. 5), 45110 (Pl. IV. fig. 2), 45111, I. 3171) from the Lower Lias of Lyme Regis, Dorset, and one, no. In. 28636, from the Lower Lias (with *Ammonites guibalianus*) of Honeybourne, Gloucestershire, shows that in all the specimens the direction of the grooves on the carapace is precisely the same as in the new specimen. The present evidence consequently necessitates a new figure of the carapace, and since one of the above specimens, no. 45110 (Pl. IV. fig. 2), has been prepared to show more completely the first to sixth abdominal segments, these, with the telson, allow a combined figure of the carapace and abdomen to be given.

So far as at present known *Æger lævis* seems to be confined to the Lower Lias.

Genus *ÆGER* Münster, 1839.*Æger lævis* (Blake). (Pl. IV. figs. 1–3.)

1855. *Astacus levigatus* M. Simpson, Foss. Yorks. Lias, p. 135 (nom. nud.).

1876. *Eryma lævis* J. F. Blake, in Tate and Blake, Yorks. Lias, p. 429, pl. xvi. fig. 3.

1925. *Æger lævis* (Blake); H. Woods, Paleont. Soc. Monogr. Macrurous Crust. p. 6, text-fig. 1, pl. i. figs. 3–5.

1929. *Æger lævis* (Blake); M. F. Glaesener, Foss. Catalogus, p. 52.

Distribution.—Lower Lias: Lyme Regis, Dorset. Lower Lias (with *Amm. guibalianus*): cutting at Honeybourne, Gloucestershire. Lower Lias (*oxynotus* zone of Tate and Blake): near Whitby, Yorkshire, and near Miller's Nab, Robin Hood's Bay, Yorkshire. Recorded by H. B.

Woodward from the Lower Lias (*jamesoni* zone) of Warwickshire.

Holotype.—This came from the *oxynotus* zone of the Peak, Yorkshire, but cannot now be traced. The locality stated for the holotype might include the locality of the new specimen (no. In. 28597).

Description.—Carapace laterally compressed, rounded dorsally, but carinate near the anterior end. Rostrum rather short, prominent, its carina sharp. A short but prominent postorbital carina is present on each side, and terminates in a spine or point in front; from the base of each spine a low ridge converges towards the rostrum. Branchial margin convex, with a marginal sulcus. Antero-ventral margin slightly concave at the level of the hepatic groove.

The cervical groove starts at one-third of the distance from the dorsal to the ventral margin, and slopes steeply forward, but does not quite reach the ventral margin; this groove joins the nearly horizontal hepatic groove at an acute angle; within this angle the surface is produced into a short spine (the hepatic spine). The hepatic groove is bent downwards below the postcervical groove and extends a little beyond it. The postcervical groove starts on the side of the carapace at a short distance from the posterior end and nearly reaches the hepatic groove at a point a little in front of its posterior end. Just above the hepatic groove is a short horizontal groove at each end of which is a fairly deep obtusely angular pit. At about one-third of the distance from the posterior end of the carapace a short and fairly deep transverse groove is present, and this extends, although more faintly marked and in some cases discontinuous, down the carapace to near the dorsal end of the cervical groove and to a little below its level. This faint groove then bends at an acute angle and extends backwards horizontally to join the postcervical groove. A further almost imperceptible groove runs near to and almost parallel with the postcervical groove on its anterior side, and is bounded below by the faint groove.

Abdomen longer than the carapace, each somite overlapping that in front. Second to fifth somites with the anterior third raised and rounded, the surface not pitted, and marked off from the posterior two-thirds by a well-defined groove. The first somite is of about

the same length as the posterior two-thirds of the second to fifth somites, and as its anterior margin is raised to form a distinct rim it is apparently narrower than the second to fifth somites. In front of it, however, and overlapped by it, is a rounded segment, devoid of pits, and similar in all respects to the anterior part of the second to fifth somites. The cleaning of the posterior margin of this rounded segment shows quite clearly that the calcification is continuous, and its separation from the first abdominal segment is only apparent, due to the formation of a deep fold which extends well under the rim. It may be that this rounded intermediate segment represents the last thoracic segment, which has become calcified to the first abdominal segment (see Calman, 1904, p. 148), and the rim formed on the anterior margin of the latter could be advanced in favour of this view. On the other hand, seeing that this intermediate segment is devoid of pits as in the anterior third of the second to fifth segments, and also agrees in shape with them, it may actually be the anterior third of the first abdominal segment, for the only modification is a deep fold instead of a groove marking off the two parts, and this is not an unexpected development in view of its position near the articulation with the carapace. I incline to the latter opinion. Pleural margins of abdominal somites rounded, with a marginal rim, fringed with minute sharp spines, but the first somite has a produced anterior angle and the sixth somite has a straight margin with only two large spines on each side. Telson narrow and pointed, the sides abruptly bent downwards; it has a deep but narrow median longitudinal groove.

Surface of carapace and posterior two-thirds of the somites with numerous minute pits. The whole surface is smooth and shiny.

LITERATURE.

- CALMAN, W. T. 1904. "On the Classification of the Crustacea Malacostraca." *Ann. & Mag. Nat. Hist.* (7) xiii. pp. 144-158.
- GLASSNER, M. F. 1929. 'Fossilium Catalogus.—Pt. 41. Crustacea Decapoda.' 464 pp., 4to. Berlin.
- MÜNSTER, G. 1839. "Beiträge zur Petrefaktenkunde.—II. Decapoda Macroura." *Abbildung und Beschreibung der fossilen langschwänzigen Krabben in den Kalkschiefern von Bayern*, pp. 1-88, pls. i.-xxix. Bayreuth.
- SIMPSON, M. 1855. 'The Fossils of the Yorkshire Lias; described from Nature. With a short outline of the Geology of the Yorkshire Coast, &c.' Pp. ii, 140, text-illustr. 8vo. London & Whitby.
- Ann. & Mag. N. Hist.* Ser. 10. Vol. xi. 11

- TATE, R., & BLAKE, J. F. 1876. 'The Yorkshire Lias,' pp. viii, 475, xii, 23 pls., 2 maps, text-illustr. 8vo. London.
 WOODS, H. 1925-1930. Palaeontogr. Soc. Monogr. Foss. Macrurous Crustacea.—Pts. I.—VII. Pp. 1-122, pls. i.-xxvii.

EXPLANATION OF PLATE IV. Figs 1-3.

Ager laevis (Blake).

Lower Lias (*oxynotus* zone of Tate and Blake): near Miller's Nab, Robin Hood's Bay, Yorkshire.

- Fig. 1. Individual showing carapace and the abdomen including the telson. Brit. Mus. In. 28597. $\times 1\frac{1}{2}$ diam.

Lower Lias: Lyme Regis, Dorset.

- Fig. 2. Abdomen of another individual, showing the shape of the first to sixth segments (telson missing). Brit. Mus. 45110. $\times 1\frac{1}{2}$ diam.

- Fig. 3. Reconstruction, based mainly on the above two specimens. About nat. size.

XX.—*The Machæridian* *Lepidocoleus ketleyanus* (Reed ex Salter MS.). By THOMAS H. WITHERS, F.G.S., of the British Museum (Nat. Hist.).

[Plate IV. fig. 4.]

THE re-arrangement of the Holcroft collection in Birmingham University led Professor W. S. Boulton and Dr. L. J. Wills some time ago to send to me for examination a number of specimens belonging to the group Machæridia. These comprised three specimens (nos. 50, 52, 225) of *Turrilepas wrightiana* (de Koninck) and four specimens (nos. 48, 53, 60, 62) of *Lepidocoleus ketleyanus* (Reed ex Salter MS.) from the Wenlock Beds of Dudley, Worcester-shire.

One of the specimens (no. 62) of *Lepidocoleus ketleyanus* is a really beautiful example, and is very much more complete than those figured in my Catalogue (1926, Brit. Mus. Cat. Machæridia, p. 20, pl. iii. figs. 1-10). It not only allows of a more accurate diagnosis of the species, but it shows that the species has a greater length than any other so far known.

Lepidocoleus ketleyanus (Reed ex Salter MS.).

(Plate IV. fig. 4.)

(For synonymy, see Withers, 1926, Brit. Mus. Cat. Machæridia, p. 20.)

Diagnosis.—Shell with at least sixty-five plates in a column and attaining a length of 68.5 mm. and a width

of 4.8 mm. Plates shaped like a saddle-flap, transversel; oblong and convex, nearly three times as wide as high; fixed margin straight; free margin rounded; distal margin almost straight, but with slight sigmoidal curve; proximal margin concave in the middle and convex at the sides. Ornament exceedingly fine, close-set, but not raised lines, concentric in the apical region and then parallel to the free margin; not always readily discernible.

Distribution.—Middle Silurian, Salopian, Wenlock Beds: Dudley, Worcestershire.

Description.—Shell (Pl. IV. fig. 4) sigmoidally curved, the upper half having the broad edge (back) on the right side and the basal half so twisted that the broad edge is shown uppermost except near the base, where it is on the left side. As it lies the shell has a length of 68.5 mm., with the distal extremity slightly incomplete and the proximal extremity more incomplete. Although the shell is incomplete there are as many as sixty-five plates in a vertical row. The greatest width is near the base, and this is equal to the height of the exposed surface of three plates, but in some parts of the shell the width is equal to the exposed surface of four plates.

Remarks.—This specimen shows that *L. ketleyanus* exceeds in length and number of plates to a column all the other known Silurian species, but it is only a little longer than the holotype of *Lepidocoleus sigmoideus* Withers, from the Middle Ordovician, Trenton Limestone, of Belleville, Ontario, Canada. This latter species, however, is a much wider form, for although the length is similar, namely 64 mm., it has a width of 6.5 mm., which is equal to the height of the exposed surface of seven plates.

Apart from other considerations, the long worm-like form of the shell, and the numerous plates in a column should certainly go a long way in preventing the reference of these forms to the subclass Cirripedia.

EXPLANATION OF PLATE IV. FIG. 4.

Lepidocoleus ketleyanus (Reed ex Salter MS.).

Silurian, Lower Salopian, Wenlock Beds: Dudley,
Worcestershire.

Fig. 4. The largest known individual (basal extremity incomplete).
Birmingham University (Holcroft Coll.), 62. $\times 1\frac{1}{2}$ diam.

BIBLIOGRAPHICAL NOTICE.

The Nidification of the Birds of the Indian Empire. By E. C. STUART BAKER, C.I.E., O.B.E., F.Z.S., &c. Vol. I. Pp. xxiii+479, and 8 Plates. Taylor & Francis, Red Lion Court, Fleet Street, London, E.C. 4. Price 30s.

It is now forty-three years since the publication of A. O. Hume's work on the 'Nests and Eggs of Indian Birds.' In this period a very large amount of fresh information has accumulated relating to birds the nidification of which was then unknown. This, combined with the fact that the trinomial system of nomenclature has also been recently introduced, with the consequent recognition of subspecies, has made a new and up-to-date account of the nesting of Indian birds most desirable.

The issue of the present work by Mr. Stuart Baker is therefore opportune and will supply a real need.

Mr. Baker is, moreover, well equipped for the task. He has always been a keen egg-collector and ornithologist, and a quarter of a century spent in the "hills south of the Brahamputra," one of the richest countries in birds in the Indian region, was not wasted. His collection of Indian eggs, including, in addition to those of his own taking, many other valuable collections subsequently acquired, is quite unique, and the volume of the accompanying data at his disposal is immense.

Vol. I., which has just appeared, embraces the first half of the order "Passeres"—nine families, which include the Crows, Tits, Parrot-bills, Nuthatches, Laughing-Thrushes and Babbblers, Bulbuls, Wrens, Creepers, and Dippers.

The serial numbers of the species and subspecies dealt with correspond with those of the Revised Edition of the 'Fauna of British India, Birds.' This is excellent, and was, in fact, essential to facilitate references.

Mr. Baker has systematized to some extent the trivial nomenclature by omitting the surnames of people and substituting for them geographical names based on range and distribution. This refers mainly to subspecific names, and the change is all to the good.

The nidification of 408 varieties of birds is described in this volume out of a possible 494, the nests and eggs of the remaining 86 species and subspecies being as yet unknown. In Hume's time the nidification of 52 per cent. of the birds then known was unknown; now this figure has been reduced to 18 per cent., and that on a much larger total of birds.

To the student of Indian oology this book will be invaluable. It gives a fund of information regarding the nesting-habits and eggs of all species dealt with, as well as good descriptions of

the types of locality in which nests occur, together with geographical and altitudinal limits.

We now come to the weak spot. Most of the nest and egg data which has gradually accumulated since systematic work commenced in Hume's time down to the present was collected before the recognition of subspecies: hence these data can only be allotted to the proper subspecies by locality. Assuming that localities have been correctly given, the allocation to the subspecies can be correctly made provided the distributional range of all subspecies is accurately known. This is, of course, just what is *not* known about so many subspecies. Take, for instance, such species as *Leiopteiia capistrata*, *Fulvetta vinipecta*, *Molpastes cafer*, or *Troglodytes troglodytes*. Who would be prepared to say exactly where their subspecies respectively meet? It will be long before this information will be completely available for all races, and until this is the case we are not justified in assuming that nests or eggs taken in any given locality can be safely identified with a given subspecies.

A few less important points will now be mentioned. It is noticed that the spelling Kuman has been adopted for the Civil Division in which Naini Tal is situated: this spelling enters into the trivial names of two birds, viz., nos. 145 and 410 a, as well as in many other places. The correct, as well as the officially accepted, spelling of this name is Kumaon, which is also how it is pronounced. Kumaon is such a well-known name that it is a pity to conceal its identity by misspelling it.

Again, on page 156 *Turdus* has been entered, twice, by mistake for *Turdoides*. Also, on page 220, line 11, the reference to the "Tenasserim race of Wren-Babbler" should read "the Shan States small Wren-Babbler."

The following misspellings have also been noticed, which should be corrected in order to facilitate the recognition of the places or plants referred to :—

- Page 68, line 29, for *ceria* read *aria*.
 „ 144, „ 6, for Shardu read Skardu.
 „ 163, „ 27, for *Catatropos* read *Calatropis*.
 „ 188, „ 1, for Mahaldorum read Mahalderam.
 „ 264, „ 4, for Tonghe read Tonglu.
 „ 271, „ 14, for Agar Pata read Ayarpata.
 „ 327, „ 40, for Barti read Basti.
 „ 338, „ 40, for Nangtba read Nagtiba.
 „ 343, „ 18, for Chikaldar read Chikalda.
 „ 349, „ 25, for Nangtba read Nagtiba.
 „ 398, „ 38 & 40, for lankana read lantana.

It is a pity it has not been found possible to produce the book at a more moderate figure: it is hoped that its price will not adversely affect its popularity, as its general distribution is bound to act as a stimulus towards the discovery and record of information relating to the nesting of species whose eggs are still unknown.

MISCELLANEOUS.

A Vote on some Echinoderm Names.

To the Editors, Annals and Magazine of Natural History.

SIRs,—My friend Dr. Th. Mortensen has just sent me a copy of his paper with the above title (*Ann. & Mag. Nat. Hist.*, October 1932, p. 345). Having seen all the proposals and voted on those of which I had fairly accurate personal knowledge, I have nothing more to say concerning them. There are, however, two phrases in the second of Dr. Mortensen's introductory paragraphs that seem to call for comment.

Although himself serving as a substitute member of the International Commission on Zoological Nomenclature, he seems to have misconceived the Commission's attitude to his proposed subcommittees for various larger groups of animals and, in particular, for Echinodermata. The fact is that the Commission has for some time past favoured the setting up of such subcommittees (see par. 27 of the Commission's Report, *Atti Congr. Internaz. Zool.*, Padova, 1930, vol. i. p. 91). Had Dr. Mortensen submitted names of persons for the subcommittee he was asked to constitute, they would no doubt have been endorsed by the Commission. Since he has, after all, preferred to act as an individual, his next step is formally to submit the proposals of himself and colleagues to the Commission without delay.

The reason I ask you to publish this comment is lest any other groups of specialists should be led to suppose that the International Commission does anything but welcome such help as they can give.

Yours faithfully,

F. A. BATHER.

46 Marryat Road,
London, S.W. 19.
25th November, 1932.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 62. FEBRUARY 1933.

XXI.—*New Species and Subspecies of Arctiinae.*
By Lord ROTHSCHILD, Ph.D., F.R.S.

(1) *Idalus quadratus*, sp. n.

♂.—Nearest to *I. pichesensis* Dyar, but much smaller. Coloration of pectus, head, thorax, and abdomen similar to *pichesensis*, but with paired brown spots on prothorax between the tegulae. Fore wing: basal third butter-yellow, outer two-thirds lemon-yellow, a fan-shaped basal patch formed by dark grey intraneural streaks; discal band of grey intraneural lines very strongly concave distad and extended narrowly along costa to apex. Hind wing: anal half deep rose, costal half white, strongly quadrate in shape, and with very extensive scent-organ in costal third.

Fore wing 20 mm. Expanse 47 mm.

Hab. Brusque, Sta. Catharina, Brazil.

(2) *Prumala distincta*, sp. n.

Nearest to *P. indistincta* Roths., but with heavier markings.

♂.—Pectus and head yellow, antennae dark brown, tip white, patagia and tegulae yellow, inner edges of tegulae and thorax dull crimson, abdomen above crimson,

Ann. & Mag. Nat. Hist. Ser. 10. Vol. xi. 13

last joint and anal tuft yellow, below all dull yellow. Fore wing golden-yellow, two subbasal brown dots, three sooty-brown spots below subcostal vein, beyond which are two subapical similar spots, larger semi-connected and surrounded by narrow red line, a discal irregular patch of brownish mauve below median obliquely covering the wing beyond basal fifth to tornus and surrounded by scarlet lines, a transverse line of ill-defined mauve-brown spots beyond middle of wing and a submarginal row of black dots. Hind wing: anal half deep rose, distal half semivitreous rosy-buff.

♀.—Head and thorax golden-yellow, abdomen sulphur-yellow. Fore wing golden-yellow on antimedial band of mauve-brown ill-defined spots from subcostal nervure to inner margin, one dot at apex of cell 3 beyond it mauve-brown, two brown-mauve ill-defined spots on each side of vein 2, and a postmedian and submarginal row of similar dots, a large patch of sooty brown-mauve at tornus.

Fore wing, ♂ 22 mm., ♀ 23 mm. Expanse, ♂ 50 mm., ♀ 52 mm.

Hab. Iguasu, Parana, 4 ♀, Nov. 1921; 1 ♂, type, Ypiranga, São Paulo, Sept. 1922, and 1 ♂, Alto da Sierra, São Paulo, April 1925 (*R. Spitz*).

(3) *Prumala fogra spitzzi*, subsp. n.

♂.—Differs from *fogra fogra* in its smaller size, uniform dark grey pectus, whiter palpi, and uniform sooty-black abdomen above and on the sides. It differs also in the fore wing being much darker above and below, owing to the great reduction of the white coloration and the more sooty black of the dark pattern.

♀.—Differs from ♂ in having the sides of the abdomen and anal segment yellow.

Fore wing : *f. fogra*, ♂, 22 mm. Expanse 49 mm.

„ *f. spitzzi*, ♂, 19 mm. Expanse 43 mm.

„ *f. spitzzi*, ♀, 22 mm. Expanse 49 mm.

Hab. Alto da Sierra, São Paulo, 13 ♂♂, 5 ♀♀, Nov. 1922.

(4) *Prumala similima*, sp. n.

♀.—Differs from *similis* Rothsch. by the much thinner oblique subapical line of fore wing, which is also further

from the apex, and in the irregular NOT cruciform dark marking at end of cell.

Fore wing 17 mm. Expanse 39 mm.

Hab. Muzo, Rio Cantinero, Columbia, 400 m. = 1300 ft. (*A. H. Fassl*).

(5) *Prumala angulifascia*, sp. n.

♂.—Pectus dark buffy yellow, head yellow, line on occiput scarlet, patagia and tegulae yellow narrowly edged with scarlet, inner edges of tegulae broadly sooty brown, thorax yellow, abdomen above and laterally rosy red, below cream-white. Fore wing: basal two-fifths obliquely sooty mauve-brown with basal half of costal-subcostal area yellow and a yellow spot on inner margin, within this dark area are various crimson (or scarlet) lines, outer three-fifths of fore wing yellow with a large-angled almost L-shaped purple-brown subapical patch of violet-brown, between which and the dark basal area are three brown dots, and a row of submarginal dots between apex and tornus. Hind wings semivitreous pale rosy buff, abdominal half rose-colour.

Fore wing 23 mm. Expanse 51 mm.

Hab. Rio Songo, Bolivia, 750 m. = 1470 ft. (coll. *Fassl*), 1 ♂, type.

(6) *Zatrephes mossi*, sp. n.

♂.—This very distinct species is nearest to *foliacea* Rothsch., but is at once distinguished by its bright salmon-coloured NOT golden-buff hind wings; pectus dull white, head, patagia, and tegulae cream-white, antennae white with brown serrations, thorax and abdomen wood-brown, the latter slightly tinged with red. Fore wing greyish cream-colour sparsely vermiculated with brown, an antimedial transverse line angled at costa and a postmedian line wood-brown, the space between these lines more heavily vermiculated with brown and therefore almost forming a brown transverse band, a vitreous spot coalescent with apex of discal vitreous patch reaches costa, a large brown irregular patch between veins 3 and 7 reaches from the discal vitreous patch to the outer margin. Hind wings bright salmon-pink.

Fore wing 15 mm. Expanse 35 mm.

Hab. Para (*A. Miles Moss*), 1 ♂, type.

(7) *Zatrephes bifasciata*, sp. n.

♂.—Pectus, palpi, and head greyish white, legs greyish white, coxæ above scarlet, patagia and tegulæ greyish white, thorax brown, abdomen brownish crimson. Fore wings greyish buff-white vermiculated with pale rufous, nervures except median dull brown, strong postmedian and antimedial transverse, somewhat oblique lines deep brown, costa, outer and inner margins black-brown. Hind wings: outer half semivitreous rosy white, abdominal half salmon-rose; ♀ larger, paler, and duller.

Fore wing: ♂, 18 mm. Expanse 41 mm.

♀, 22 mm. Expanse 50 mm.

Hab. 5 ♂♂, 1 ♀, St. Jean de Moroni, French Guiana (Cayenne) (received from E. L. Moulton).

(8) *Automolis pallidifascia*, sp. n.

♂.—Differs from *chrysomelas* Wlk. in having all dark markings on fore wings much reduced and narrower and slate-grey not black. On the hind wings the costal half is yellow not only one-third of the wing.

Fore wing 19 mm. Expanse 44 mm.

Hab. Alto da Sierra, São Paulo, Aug. 1924 (*R. Spitz*).

(9) *Automolis tegulata*, sp. n.

♂.—Differs at first sight from ♂ of *dolens* Druce in having the tegulæ (patagia in Hampson) black not cream-colour, only the extreme base being cream.

♀.—Differs from ♀ *dolens* in the cream outer margin of fore wing being much narrower and the tegulæ black with cream base and tip not wholly cream-colour.

Hab. 5 ♂♂, 1 ♀, Ypiranga, São Paulo, June-Aug. 1924, Alto da Sierra, São Paulo, Jan. 1925 and March 1926 (*R. Spitz*).

(10) *Automolis immarginata*, sp. n.

♂.—Differs from *dolens* Druce in lacking entirely the broad cream-white outer margin of fore wing joined to the oblique subapical band.

♀.—Differs from ♀ *dolens* in having the pale outer margin reduced to a mere hair-line.

Hab. 2 ♂♂, 1 ♀, Alto da Sierra, São Paulo, May 1925 (*R. Spitz*).

(11) *Automolis peculiaris*, sp. n.

♂.—This very curious species is nearest to *inexpectata* Rothsch.

Pectus, head, thorax, and abdomen buffish orange-yellow, antennæ deep brown, legs orange-brownish grey. Wings semivitreous white, nervures brown-grey; fore wing with costa, margino-submarginal fifth, and basal third below median vein much more opaque and more densely scaled. Hind wing with abdominal third more densely scaled brownish grey-white.

Fore wings 23 mm. Expanse 51 mm.

Hab. Para (*A. Miles Moss*).

(12) *Automolis oviplaga*, sp. n.

♂.—Pectus orange with two black spots, palpi black, legs brown streaked with white outside, head dull orange with central black dot, patagia black edged with dull orange, tegulae black-brown edged with yellowish grey, thorax and abdomen black. Fore wing black, nervures in basal two-thirds grey, a large egg-shaped white patch in apical third of wing. Hind wing: outer three-fifths black, basal two-fifths semivitreous whitish grey somewhat suffused with sooty-grey.

♀.—Similar but duller, more brownish, and with anal segment of abdomen orange. Underside of abdomen white in both sexes.

Fore wing, ♂ 19 mm., ♀ 21 mm. Expanse, ♂ 43 mm., ♀ 47 mm.

Hab. 1 ♂, 1 ♀, Alto da Sierra, São Paulo, Jan. 1923 (*R. Spitz*); 1 ♂, St. Catharina.

(13) *Automolis immaculata*, sp. n.

♂.—Differs from *zonana* Schaus in the absence of the cream patch which runs in from the outer margin of fore wing above vein 2.

Hab. Alto da Sierra, São Paulo, May and Sept. 1923–1927 (*R. Spitz*).

(14) *Automolis columbiana*, sp. n.

♂.—Differs from *semicostalis* Rothsch. in the much more velvety black of the fore wings, in the much wider oblique white subapical band of the fore wing, in the

white of the costa being much produced and joined to the subapical band, and in the apical half of abdomen being golden-orange. The head is also NOT yellow but golden-orange.

♀.—Larger and has anal segment black, and the preceding four segments have the yellow more or less marked and broken with black.

Fore wing, ♂ 18 mm., ♀ 21 mm. Expanse, ♂ 41 mm., ♀ 47 mm.

Hab. 1 ♂, 1 ♀, Bella Vista, W. Columbia, Aug. 1927.

(15) *Cissura plumbea excelsior*, subsp. n.

♂♀.—Differ from *plumbea plumbea* Hmps. in the darker and brighter more slaty-grey ground-colour and the more intense crimson, NOT dull scarlet, of the abdomen and lines of the fore wing. In the ♂ also the semi-vitreous whitish area of the hind wing is much more extended and conspicuous.

Hab. 13 ♂♂, 7 ♀♀, La Union, Rio Huacamayo, 2000 ft., Dec. 1904, La Oroya, Rio Inambari, Carabaya, 3100 ft., 1904, San Domingo, Carabaya, 6000 ft., 1902 (*G. Ockenden*).

(16) *Pelochyta spitzzi*, sp. n.

♂.—Closest allied to *dorsicincta* Hmps., but has the whole abdomen banded, NOT ONLY the apical half. Antennæ black, pectus orange with two black spots, palpi black, basal joint orange, head orange with minute dark dot, patagia, tegulæ, and thorax brownish orange, with paired black spots, abdomen black, each segment edged with golden-orange, underside of abdomen and thorax golden-orange. Fore wing orange-brown, a small black basal spot. Hind wing orange-brown, slightly semi-hyaline, abdominal fifth orange-golden washed with buff.

Fore wing 21 mm. Expanse 48 mm.

Hab. 2 ♂♂, Alto da Sierra, São Paulo, July 1926 (*R. Spitz*).

(17) *Ichnocampa ecuadorensis*, sp. n.

♂.—Pectus golden-yellow, palpi and antennæ black, patagia, tegulæ, and thorax golden-yellow. Abdomen: first two segments golden-yellow, third and fourth

segments black, rest golden-yellow, abdomen below all black except anal segment and claspers. Legs: coxæ golden-orange, rest grey-brown. Wings elongated greyish cream washed with buff, veins black; abdominal area of hind wings clothed with longish grey hair. This form is somewhat intermediate between *nigridorsata* and *nigrivena*, but is more elongated than either.

Fore wing 28 mm. Expanse 63 mm.

Hab. El Topo, Rio Pastaza, E. Ecuador, 4200 ft. (M. G. Palmer).

(18) *Opharus muricolor*, sp. n.

♂.—Pectus, head, antennæ, and thorax mouse-grey-brown, legs darker grey-brown, abdomen grey-brown, darker almost black in segmental interspaces.

Fore wings: mouse-wood-brown, nervures black-brown. Hind wing whitish wood-brown, somewhat semihyaline, darker on apical third, nervures brown.

Fore wing 22 mm. Expanse 48 mm.

Hab. Huanchabamba, N. Peru, 6800 ft.

(19) *Halisidota albiceps*, sp. n.

♂.—Pectus black-brown, legs black-brown, inside of coxæ scarlet, rest of legs ringed with scarlet. Antennæ: shaft dull scarlet, serrations black-brown. Head white with median black spot, patagia black, tegulæ black with median white band, thorax and abdomen bright crimson. Fore wing sooty black sparsely freckled with whitish scales. Hind wings sooty grey-black, somewhat irregularly semivitreous.

♀.—Differs only in having no white lines on tegulæ which are deep chocolate, the antennæ are not so red, thorax and abdomen brick-red, and wings very dark mummy-brown.

Fore wing, ♂ 22 mm., ♀ 23 mm. Expanse, ♂ 50 mm., ♀ 53 mm.

Hab. 1 ♀, Alto da Sierra, São Paulo, Nov. 1925 (R. Spitz). (There is also another specimen from São Paulo with a black head and tegulæ, but I am not sure about it.) 1 ♂ (type, Sierra do Mar, São Paulo, Feb. 1927 (F. Wucherpfennig).

(20) *Pseudalus affinis*, sp. n.

♂.—Near *aurantiaca* Rothsch. and *strigata* Rothsch., but at once distinguished by almost entire absence of orange streaking and freckling.

Head, patagia, and tegulae bright yellow, thorax and abdomen brown-red, antennae rufous. Fore wing bright yellow, somewhat darker intraneurally, an oblique antimedial line from costa to vein 1 dark rufous, a broader postmedian oblique line from apex to centre of inner margin bright deep rufous, costa and fringe narrowly rufous-brown. Hind wing pale salmon-rose.

♀.—Head, patagia, and tegulae yellow, thorax brown, abdomen pale buffish rose, antennae yellow.

Fore wing yellow with very narrow brown edging to costa and fringe; an antimedial transverse line of rufous dots, a rufous stigma in cell, an oblique line of rufous dots from apex to centre of inner margin. Hind wing pale salmon-rose.

Fore wing, ♂ 15 mm., ♀ 19 mm. Expanse, ♂ 34 mm., ♀ 43 mm.

Hab. 1 ♂, St. Jean de Maroni, 1 ♂, St. Laurent de Maroni, French Guiana (*Le Moult père et fils*); 1 ♂, Tumatumari, British Guiana, Dec. 1907 (*S. M. Klages*); 3 ♀♀, Fonte Boa, Amazons, July and Aug. 1906 (*S. M. Klages*).

(21) *Spilosoma sericeipennis*, sp. n.

A most remarkable species, unlike any other *Spilosoma*.

♀.—Palpi black, head and thorax white, abdomen above brownish orange with white edging to anal segment, antennae black. Fore wing white with intense satiny sheen with narrow black hair-lines each side of veins 3, 4, 5, 6, 7, and 8. Hind wing satiny white, costal and anal areas, an irregular patch beyond cell, the cell and a patch above vein 1 smeared densely with sooty brown-black; on each side of veins 3, 4, 5, 6, and 7 are black lines more intense and wider than on fore wing. Below wings much more strongly black; underside of abdomen white with chocolate cross-bands.

Fore wing 31 mm. Expanse 68 mm.

Hab. Tali Haut, Yunnan.

(22) *Spilosoma lewisi formosana*, subsp. n.

♂.—Differs from *lewisi lewisi* Butl. in having the black and red markings of the patagia much enlarged so as to occupy more than half their area, in having the black bands on each side of vein 2 of fore wings much lengthened and enlarged, so as to completely coalesce with the band above vein 1.

Hab. 4 ♂♂ (type), Rantaizan, Feb. and May 1909, 1 ♂, Arizan, Sept. 1906, Formosa (A. E. Wileman).

(23) *Spilosoma lewisi taliensis*, subsp. n.

♂.—This is the form identified as *lewisi lewisi* by the late Mr. Charles Oberthür. Differs from *L. lewisi* and *L. formosanum* by the bright buff not white ground-colour of fore wings, by the white not golden colour of the veins of the fore wings and in the heavier and much expanded dark bands of these wings.

Hab. 1 ♂, Tali Haut, Yunnan.

(24) *Spilosoma feminina*, sp. n.

♂♀. Resembles the ♀ of *sparsipunctata* Hmps., but is larger and has both sexes alike, and the fore wings are more produced and pointed at the apex, the black dorsal spots on the abdomen are also considerably smaller. The spotting of the ♂ fore wings is much more numerous and appears over the whole fore wings, which are yellow not cream-colour. The wings are much more translucent than in *sparsipunctata*.

Fore wing, ♂ 25 mm., ♀ 28 mm. Expanse, ♂ 56 mm., ♀ 63 mm.

Hab. 2 ♂♂, 1 ♀, Diego Suarez, Madagascar, Dec. 1916 (J. Melou).

(25) *Spilosoma comorensis*, sp. n.

♂.—Pectus orange, head orange, patagia orange-buff, tegulae and thorax pale orange-buff, abdomen bright golden-orange, dorsal and lateral rows of large black spots, three black spots set like three points of a triangle on last segment. Fore and hind wings semitranslucent yellowish buff with heavier scaling at costa, in cell, and along both sides of vein 1 in fore wing and along

costa and in abdominal area of hind wing. Antennæ black, legs brown.

♀.—Pectus, head, thorax, and abdomen orange, the latter with large dorsal and lateral black spots, antennæ and legs as in ♂. Fore wings brownish orange; hind wings golden-orange.

Fore wing, ♂ 27 mm., ♀ 31 mm. Expanse, ♂ 62 mm., ♀ 71 mm.

Hab. 1 ♂, Mayotte, Comoro Islands, May 1921; ♀, Grand Comoro Island, Aug. 1911 (*G. F. Leigh*).

(26) *Spilosoma pseudosparsata*, sp. n.

♂.—Near *sparsipunctata* Hmps. n.; pectus orange, head orange, patagia, tegulæ, and thorax cream-buff, abdomen golden-orange above, cream-colour below, with dorsal and lateral rows of black spots. Fore wing slightly diaphanous cream-buff, a row of coalescent black patches each side of vein 1, three black dots in cell, two below median, one on each side of vein 3, and one above vein 6. Hind wing semitranslucent cream-buff, abdominal two-fifths clothed with orange hair. Legs and antennæ black.

♀.—Tibiæ, pectus, and head orange, abdomen as in ♂, thorax darker cream-buff. Fore and hind wings broader and much deeper cream-buff; fore wing has the patches each side of vein 1 reduced to eleven black dots, three black dots on costa and an angled black stigma on discocellulars; a small angled stigma on discocellulars of hind wing, some orange in folds of abdominal area.

Fore wing, ♂ 25 mm., ♀ 30 mm. Expanse, ♂ 56 mm., ♀ 67 mm.

Hab. 8 ♂♂, 2 ♀♀, Grand Comoro Island, Nov. 1921 (*G. F. Leigh*).

(27) *Spilosoma castelli*, sp. n.

♂.—Pectus and tibiæ dull orange, antennæ and rest of legs black, head and thorax dark cinnamon, abdomen orange-yellow with dorsal row of black dots. Fore wing dark cinnamon, costal area paler, fringe yellow. Hind wing orange buffish yellow, a black dot in cell.

♀.—Similar, but fore wing paler, more rufous, and hind wing deeper orange, two black spots on vein 6 and one each much larger on veins 1 and 2.

Fore wings, ♂ 20 mm., ♀ 22 mm. Expanse, ♂ 45 mm., ♀ 50 mm.

Hab. 89 ♂♂, 5 ♀♀, Sédhiou, Sénégal, June 1917 (*H. Castell*).

(28) *Spilosoma castelli grandis*, subsp. n.

♀.—Larger than *c. castelli*, and the black spots much larger on hind wing, those on vein 1 and 2 coalescing.

Fore wing 25 mm. Expanse 57 mm.

Hab. 1 ♀, Bauchi Plateau, North Nigeria.

(29) *Spilosoma reticulata*, sp. n.

♂.—This fine new species stands nearest to *eichhorni* Rothsch., but is very distinct. Legs sooty black, outside of tibiæ and coxæ olive, inner side of fore coxæ orange, pectus and palpi black; head, patagia, and tegulæ orange, centre of tegulæ and thorax black, abdomen orange, a black dorsal band and lateral lines of black spots.

Fore wing cream-buff, fringe yellow, along costal area from base to apex a five times interrupted black band, cell almost entirely black, and a three times interrupted black line on inner margin, between veins 1 and 2 and the median are five black quadrate patches, the third one divided longitudinally, between veins 2 and 3 are three similar black patches, and between veins 3 and 4, 4 and 5, 5 and 6, 6 and 7, and 7 and 8 are two similar black patches. Hind wing orange-buff (or buffish orange, in costo-basal half two large irregular sooty-black patches and in outer half is a sooty-black irregular band separated into oblong spots by the yellow nervures.

Fore wing 24 mm. Expanse 55 mm.

Hab. 7 ♂♂, Talesea, New Britain, Feb.—March 1925 (*A. F. Eichorn*).

(30) *Spilosoma wahri*, sp. n.

♂.—Legs brown, coxæ pale crimson, antennæ cinnamon, palpi black; head, patagia, tegulæ, and thorax greyish wood-brown, a darker streak in centre of tegulæ; abdomen pale crimson with row of dorsal black spots. Fore wing greyish cinnamon; a basal spot and subbasal antimedial and postmedial mummy-brown transverse

bands from costa to median nervure, four patches below median nervure, two interrupted postdiscal transverse bands, and a marginal row of spots also mummy-brown. Hind wing brownish grey-buff, a discocellular stigma, an indistinct obsolete band of four or five dots, and two or three marginal streaks sooty brown, abdominal third of wing flushed slightly with rose-colour.

♀.—Legs brown, coxæ pink dotted with brown, antennæ brown, head and thorax chocolate rufous-brown, abdomen rose-crimson with dorsal rows of black spots. Fore wing chocolate rufous-brown, three irregular broken bands of black-brown blotches edged with yellow, a postdiscal patch under and on costa black-brown edged with yellow and a number of postdiscal brown spots. Hind wing salmon-crimson, a discocellular stigma, two spots near tornus and two dots near apex black. The 6 ♂♂ and 3 ♀♀ vary much in the size and extent of the dark pattern of fore wings, one ♂ having the dark markings so extended and coalescing that the basal four-fifths of the fore wing appears almost entirely black.

Fore wing: ♂ 18 mm., ♀ 22 mm. Expanse, ♂ 41 mm., ♀ 49 mm.

Hab. Suai, Portuguese Timor, 15–21 December, 1912 (*E. Wahr*).

(31) *Spilosoma inexpectata*, sp. n.

♂.—Nearest to *niceta* Stoll, but abundantly distinct.

Legs black, pectus, underside of thorax, and inside of coxæ brilliant crimson-scarlet; head scarlet, antennæ black, basal joint white; patagia black edged with yellow followed by pale scarlet, tegulæ cream-colour edged with pale scarlet and with black centre, thorax centre whitish cream, rest scarlet; abdomen crimson-scarlet with transverse black spots on segments 5–8 inclusive. Fore wing cream-colour, with cell and intra-neural spaces pale purplish red, a basal spot, a spot on median, and two spots on each side of vein 1 black, an oblique median transverse band of black spots from below subcostal nervure to inner margin. Hind wing bright rose-crimson, faintly translucent; a discocellular stigma black.

Fore wing 25 mm. Expanse 59 mm.

Hab. 1 ♂, New Ireland, January 1924 (*A. F. Eichorn*).

(32) *Spilosoma atrivenata*, sp. n.

♀.—Legs, tarsi black, tibiae and coxae dirty greyish cream-colour with black streaks; pectus, head, and thorax cream-colour; abdomen golden-yellow with broad transverse black bands. Fore wings cream-colour, veins sharply defined black. Hind wings slightly paler cream-colour, veins showing faintly and narrowly sooty black.

Fore wing 21 mm. Expanse 48 mm.

Hab. 1 ♀, Kalambo River, south end of Tanganyika.

(33) *Spilosoma nyasana*, sp. n.

♂.—Legs, tarsi black, basal joint white, tibiae and coxae buffish outside, black inside, pectus wood-brown, head yellow-buff; antennae black; thorax cream-colour, patagia edged with dirty yellow; abdomen golden-yellow, a dorsal black line from segment 2 to segment 7 and a double row of lateral black dots. Fore wings cream-colour, veins narrowly brown. Hind wings cream-colour, costal and abdominal areas buffish yellow.

Fore wing 23 mm. Expanse 52 mm.

Hab. Zomba, Nyasa, Dec. 1922 (*H. Barlow*).

(34) *Spilosoma bipartita*, sp. n.

♀.—This may be the ♀ of the preceding, but I do not think so.

Head, thorax, and fore wings cream-white; abdomen and hind wing yellow, dorsal spots on segments 3, 4, 5 of abdomen and stigma on hind wing black.

Fore wing 23 mm. Expanse 51 mm.

Hab. Zomba, Nyasa, July–Aug. 1925 (*H. Barlow*).

(35) *Spilosoma postflavida*, sp. n.

♀.—Pectus and head dull yellow; antennae brown; thorax cream-colour with a pair of black dots; abdomen golden-yellow with four black dorsal spots.

Fore wing cream-colour with three wavy serpentine transverse lines of black spots, two oblique subapical and a terminal row of black dots. Hind wing yellow with four black spots.

Fore wing 21 mm. Expanse 47 mm.

Hab. 1 ♀, Kafakumba, Congo Belge, 20th Dec., 1924.

(36) *Spilosoma togoensis impunctata*, subsp. n.

♂.—Differs from *togoensis togoensis* Bartel above in having no black spot on the discocellulars or only an indication of one and in being larger.

Fore wing: *t. apuncta*, ♂, 23 mm. Expanse 52 mm.

t. togoensis, ♂, 19 mm. Expanse 44 mm.

Hab. 1 ♂, Abinsi River, Benue, Nigeria, April 1912; 1 ♂, Fort Sibut, Haut Chari-Tchad; 1 ♂, Yoko, Cameroons, April 1911.

(37) *Amsacta latimarginalis*, sp. n.

♂.—Differs from *marginalis* Walk. in its much darker more sooty ground-colour, in the yellow head and patagia; in the bright yellow abdomen with dorsal row of black spots NOT dark, abdomen narrowly ringed with yellow; in the costal third of wing being yellow, and in the much more extensive yellow fringes. ♀ shows some differences from ♀ *marginalis*, but the ground-colour of wings is sooty grey NOT sooty black as in the ♂.

Fore wing, ♂ 15 mm., ♀ 19 mm. Expanse, ♂ 34 mm., ♀ 43 mm.

Hab. 1 ♂, 1 ♀, Tambura, Southern Bahr-el-Ghazal (type); 3 ♂♂, Fort Crampel, French Congo; 1 ♂, Mataza, Lado Enclave, July 1912.

(38) *Amsacta latimarginalis elongata*, subsp. n.

♂.—Differs from *l. latimarginalis* in the longer narrower wings and in the much narrower yellow fringes and in the yellow tegulæ.

Fore wing 16 mm. Expanse 36 mm.

Hab. Kasangazi, nr. Bandawi, 3000 ft. above Lake Nyassa (Dr. Prentice).

(39) *Amsacta senegalensis*, sp. n.

♂.—Pectus and palpi yellow, fore coxæ scarlet, antennæ black, head and thorax cream-white, two black dots (one each) at base of tegulæ, abdomen scarlet, first segment and segmental interspaces white, a dorsal row of black spots. Fore wing cream-white, costa scarlet, nervures heavily picked out in cinnamon-brown. Hind wings white, a spot in cell and four submarginal

spots sooty brown, veins 2, 3, 4 picked out, but less strongly with cinnamon. ♀ similar, but sooty-brown spots on hind wing, smaller and nervures on hind wing not picked out in cinnamon.

Fore wing, ♂ 19 mm., ♀ 22 mm. Expanse, ♂ 43 mm., ♀ 49 mm.

Hab. 103 ♂♂, 17 ♀, Sédhion, Sénégal, June 1917 (*H. Castell*).

(40) *Amsacta pulchra*, sp. n.

♀.—Tibiæ and tarsi black ringed with white, coxæ crimson; pectus white; frons white with central dark dot, vertex silver-grey, collar crimson; patagia white with black spot on outer side; tegulæ white with central black band on basal two-thirds; thorax white with black central spot towards the hinder end; abdomen crimson with dorsal rows of black spots. Fore wing milky white, costa dark yellow, fringe yellow, a central black horizontal band from base of wing to outer margin, within which the median nervure and basal portions of veins 2, 3, and 4 show yellow, two black dots, one above and one below, vein 1 in basal half of wing, a broken line of black spots from costa to central band in cell and a less defined similar one from costa to discocellulars, an oblique band of black coalescing spots from costa to inner margin halfway between discocellulars and outer margin, three black subapical spots. Hind wing white, three marginal spots and a discocellular stigma black.

♂.—Similar, but smaller.

Fore wing, ♂ 15 mm., ♀ 19 mm. Expanse, ♂ 34 mm., ♀ 42 mm.

Hab. 3 ♂♂, 3 ♀♀, Kibwesi, British East Africa, Nov. 1920 (*W. Feather*) (♀, type).

(41) *Cretonotus auremaculatus*, sp. n.

♂.—Legs and pectus black; head, forehead, and antennæ black, vertex crimson; thorax black, a slight golden patch on patagia; abdomen crimson, basal segment and dorsal line of spots black. Fore wing black, a quadrate patch in cell white, an oblong oblique band from median vein to vein 1 near tornus white.

Hind wing black, variegated with orange on abdominal area, some ill-defined spots at discocellulars orange.

Fore wing 19 mm. Expanse 42 mm.

Hab. 1 ♂, Diego Suarez, Madagascar, Jan. 16 1917 (*J. Melou*).

(42) *Cretonotus funereus*, sp. n.

♂.—Coxæ, pectus, thorax, and abdomen below and palpi gallstone-yellow; head yellow with black dot; patagia black edged with yellow; tegulæ and thorax sooty black. Fore wing sooty black, nervures yellowish grey, an oblique white band from subcostal nervure to vein 2. Hind wing sooty black, underside of hind wing gallstone-yellow with a broad black marginal band. Abdomen black with narrow grey lines.

Fore wing 18 mm. Expanse 40 mm.

Hab. 1 ♂, Warri, Niger, July 1897 (*Dr. Roth*).

(43) *Cretonotus truncatus*, sp. n.

♂.—Both wings much truncated in tornal area, which, together with swollen appearance of the costa of fore wing and the stout short body, gives this insect somewhat the aspect of a Limacod. Pectus, head, and patagia scarlet, pectus with one pair patagia, two pairs of black dots; thorax and abdomen black. Fore wing black with postmedian strongly curved irregular white band. Hind wing black with brownish central discal area and near base. Hind wing below yellow, with broad black border except on basal half costal area.

Fore wing 18 mm. Expanse 41 mm.

Hab. 1 ♂, Takwa, Gold Coast (*R. E. James*).

(44) *Cretonotus postrubidus*, sp. n.

♂.—Pectus and head scarlet, antennæ black, patagia and tegulæ black edged with dull scarlet, thorax black; abdomen dull scarlet, anal tuft and dorsal row of spots black. Fore wing brown-black, nervures gallstone-yellow, an oblique white band from subcostal across end of cell to tornus above vein 1. Hind wing orange-scarlet, a broad black margin from outer third of costa to tornus narrowing towards tornus.

Fore wing 20 mm. Expanse 45 mm.

Hab. 1 ♂, Sandoa, Congo, 7. xi. 1920.

(45) *Cretonotus marginalis confluens*, subsp. n.

♂♀.—Differs from *marginalis marginalis* Walk. in its considerably smaller size and in the greater extension of the brown of the disc of fore wing, which in the ♂ type has spread so much that it has almost covered the white spots, leaving only a few white streaks; in the second ♂ the brown disc is less extended, leaving some larger white markings, while in the ♀ the white forms a nearly unbroken band all round, NOT a series of quadrate patches. In the type ♂, on the hind wing, veins 2, 3, 4, and 6 are more or less brown.

Fore wing: *m. marginalis*, ♂ 21 mm., ♀ 23 mm. Expanse, ♂ 47 mm., ♀ 52 mm.

m. confluens, ♂ 17 mm., ♀ 20 mm. Expanse, ♂ 39 mm., ♀ 45 mm.

Hab. Sédhiou, Sénégal, June 1917 (*H. Castell*).

(46) *Cretonotus sudanicus*, sp. n.

♀.—Nearest to *marginalis* Walk.

Pectus yellow with sooty spots; head cream-white; patagia, tegulæ, and thorax cream-white with black dots; abdomen above orange with a dorsal row of small black streaks and a black spot above anal tuft. Fore wing mummy-brown encircled by a row of ten margino-submarginal buff patches edged with white, base of wing also buff edged with white. Hind wing yellow-buff (or buffish yellow), a brown patch on discocellulars, a median brown streak, a postmedian transverse irregular brown band, and an irregular brown marginal band from apex to vein 1. Underside of thorax dark sooty brown with cream spots; underside of abdomen dark sooty brown with three rows of cream spots.

Fore wing 23 mm. Expanse 50 mm.

Hab. Ludi, Lado Enclave, 26 March, 1912.

(47) *Cretonotus wilemani*, sp. n.

This species is very close to *transiens* Wilkr., but is at once distinguished by both sexes being alike, whereas in *transiens* the ♀ is pale greyish buff, while the ♂ is mouse-grey.

♂♀.—Head and thorax pure white, abdomen above golden-orange with well-developed dorsal row of black

spots. Fore wing earth-brown, costo-subcostal area from base to apex pure white (in ♂ *transiens* this is whitish grey and in the ♀ of the same of the colour of rest of fore wing). Hind wing semivitreous earth-brown.

Fore wing, ♂ 25 mm., ♀ 28 mm. Expanse, ♂ 55 mm., ♀ 62 mm.

Hab. 7 ♂♂, 11 ♀♀, Palali, 2000 ft., Benguet, Klon-dyke, 800 ft., Benguet, Luzon, April 1912, Luzon, July 1913, Kolambugan, Lanao Plains, Mindanao, May 1914 (*A. E. Wileman*); Luzon (*Dr. Meyer*) (ex *Felder* coll.).

(48) *Cretonotus perineti*, sp. n.

♀.—Similar to *leucanioides* Holl., but at once distinguishable by the absence of the black dorsal stripe on patagia and thorax, and by the much more sharply defined black lines and streaks on the fore wings. Pectus, legs, and antennæ sooty black. Head and thorax cinnamon-brown, abdomen above crimson with median line of black bands, and a black patch on anal segment, sides of abdomen black with oblique narrow white streaks; underside of abdomen cinnamon-brown with central row of black dots. Fore wing pinkish cinnamon, a black median band along median vein from base of wing to base of vein 2, three black postmedian dots, one below subcostal, one on discocellulars, and one under vein 2 halfway to outer margin, a black submarginal streak on vein 5.

Hind wing semivitreous white, two discocellulars and three marginal dots black.

Fore wing 19 mm. Expanse 43 mm.

Hab. 3 ♀♀, Station Perinet, 149 km. east of Tananarivo, 20 Oct. to 10 Nov., 1930 (*Mme d'Olsouffieff*).

(49) *Estigmene madagascariensis*, sp. n.

♂.—Orange-yellow. Legs grey-black, outside of coxæ and tibiae dull orange; pectus dull orange; antennæ black; head and thorax orange; abdomen above orange, segments 3 to 7 black with orange-buff edges. Fore wings buffish orange, in the cell, in the intraneural spaces, and along median vein from base of wing to outer margin broad streaks of brownish grey. Hind wings

semivitreous buffish orange-yellow with faint indications of intraneural darker streaks.

Fore wing 18 mm. Expanse 41 mm.

Hab. 2 ♂♂, Station Perinet, 149 km. east of Tananarivo, 20 Oct. to 10 Nov., 1930 (*Mme N. d'Olsouffieff*).

(50) *Estigmene octomaculata*, sp. n.

♀.—Legs greyish cream-colour, coxæ dull yellow; pectus yellow with two black streaks; antennal shafts cream-colour, pectinations black; head and thorax cinnamon-cream-colour, thorax with central black spot; abdomen yellow with dorsal row of black spots, anal tuft cream-colour.

Fore wing greyish-buffy cream-colour, two black dots one above the other on basal fourth of wing between median vein and vein 1, a black dot on lower discocellular. Hind wing white, a black spot in cell.

Fore wing 18 mm. Expanse 41 mm.

Hab. Solan, Aug. 1896.

(51) *Estigmene senegalensis*, sp. n.

♂.—Legs yellow, front of fore tibiae black; pectus and head yellow; thorax cream-white; abdomen yellow, third and fourth segments above black. Fore and hind wings cream-colour (or cream-white), two confluent black dots on lower discocellular of fore wing.

Fore wing 16 mm. Expanse 36 mm.

(52) *Estigmene testaceoflava*, sp. n.

♂.—Pectus and palpi grey; antennæ black; thorax grey-buff; abdomen yellow. Fore wing buff, costa, fringe, area along median vein, and vein 1 darker. Hind wing buffish yellow. ♀ similar, but brighter; 1 ♀ shows some tiny black spots on median vein.

Fore wing, ♂ 18 mm., ♀ 19 mm. Expanse, ♂ 41 mm., ♀ 43 mm.

Hab. 11 ♂♂, 6 ♀♀, Sédhiou, Sénégal, July 1917 (*H. Casteln.*).

(53) *Pericallia nephelistis diaphana*, subsp. n.

♂♀.—Differs from *N. nephelistis* Hampson. in being markedly semivitreous, in the transverse dark markings

being more separate and better defined, in the yellow of the hind wing being much duller, and in the spots on the hind wing being joined into bands like in ♀ *nephelistis nephelistis*.

Hab. Kibwesi, British East Africa, April 1922 (*W. Feather*), 1 ♂, 1 ♀.

(54) *Pericallia affinis*, sp. n.

♀.—Nearest to *nephelistis* Hmps., but distinguished at once by its crimson NOT yellow abdomen.

Pectus dull pink with two black spots; palpi dull pink ringed with black; legs sooty black ringed with yellow; antennæ dark brown ringed with yellow; head and thorax wood-brown, tegulæ darker in centre; abdomen above crimson with row of diamond-shaped black spots, abdomen below and on sides black with yellow bands. Fore wing sooty brown densely powdered with yellow scales, on disc of wings and especially beyond centre alternate irregular crenulated transverse bands of sooty black and yellow as well as dark spots along costal and inner areas. Hind wing pale yellow with a sooty stigma and interrupted ill-defined postmedian bands sooty black.

Fore wing 24 mm. Expanse 54 mm.

Hab. Anos Mts., 1150 m. = 3988 ft., nr. Windhook.

(55) *Pericallia galactina latifascia*, subsp. n.

♂♀.—Nearest to *galactina trigonalis* Voll., and has the same salmon-red hind wings. Differs abundantly by the chocolate bands and stripes of the fore wing being much broader.

Hab. 1 ♂, 2 ♀♀, Andaman Islands, June 1896 (ex coll. Fawcett).

(56) *Pericallia galactina intermedia*, subsp. n.

♂.—Exactly intermediate in colour of hind wings between *galactina galactina* Hoev. and *galactina trigonalis* Voll., having yellow hind wings saturated with salmon-colour.

Hab. 1 ♂, Government Hill, Penang, 2500 ft., March 1908.

[*Apantesis fasciata oberthuri* Oberth.

This form was described from Batna, and I have 3 ♂♂, 1 ♀, from there and 65 ♂♂, 57 ♀♀, from Blida Glacières and some places round Alger. Now, the three Batna ♂♂ are extremely pale and yellowish in coloration, and the hind wings of the ♀ have the colour much paler than those from the north. When we get more Batna ♀♀ for comparison, and should it be confirmed that the Aurès Mts. specimens are always paler, the form from Blida will require a name.]

(57) *Stenarctia rothi*, sp. n.

♂.—Legs brown, coxæ crimson, pectus rose-crimson; palpi brown; head and thorax cinnamon chocolate-brown; antennæ black; abdomen crimson with dorsal and lateral lines of black spots. Fore wing cinnamon chocolate-brown, two black dots in cell, one similar on costa from which runs a faint serpentine transverse darker brown line, and a postdiscal distinct, curved, transverse line also deeper in colour. Hind wing sooty black.

Fore wing 14 mm. Expanse 31 mm.

Hab. 1 ♂, Warri, Niger, June 1897 (*Dr. Roth*).

(58) *Seirarctia abyssinica*, sp. n.

♂.—Legs, pectus, head, antennæ, and thorax black; abdomen above yellow with two dorsal rows of black spots below black. Fore wing black powdered with darker black scales and with two postmedian intense black transverse bands just showing. Hind wing yellowish buff, a central and a submarginal spot black.

Fore wing 19 mm. Expanse 44 mm.

Hab. 1 ♂ (type), Maraco, Central Abyssinia, 17th April, 1915 (*O. Kovacs*); 1 ♂, Omo River, between Kambatta and Djimma, S.W. Abyssinia, May 3-7, 1925 (*Oscar Neumann*); 3 ♂♂, Maraquo, Central Abyssinia, June 1914 (*O. Kovacs*).

(59) *Seirarctia subapproximans*, sp. n.

♂.—Legs black; pectus and palpi vermilion-red; head and thorax rufous-brown; abdomen orange with black bands on the sides and long rose-coloured hair

on the first two segments almost hiding the yellow and black markings. Fore wing rufous-cinnamon, densely irrorated and strigillated with black, a black discocellular stigma, base of wing below vein 1 rose-colour. Hind wing rosy white, fringe and costa pale rose-colour, a black central stigma.

Fore wing 22 mm. Expanse 51 mm.

Hab. 9 ♂♂, Morogoco, Kibuco.

(60) *Turuptiana flavescens*, sp. n.

♂.—This species appears very variable in the extent of the black markings on the fore wings, as the 3 ♂♂ vary from pure yellow with three very narrow transverse black lines to sooty black, with one postmedian transverse yellow line and some confused yellow smears on the disc of the wing. Legs, pectus, head, antennæ, and thorax deep black; abdomen deep black, last three segments yellow laterally.

Fore wing golden-yellow, base, margin, stigma, and anti- and postmedian transverse bands black, between these bands and below vein 1 the yellow is clouded with black. Hind wing golden-yellow with a minute discocellular and three minute marginal dots brown. In the darkest ♂ there is a sooty-brown border to the hind wing extending from vein 2 to vein 8. Nearest allied to *T. sanguinea* Hmps.

Fore wing 13 mm. Expanse 28 mm.

Hab. Lake Titicaca.

(61) *Calidota strigosa bahamensis*, subsp. n.

♂.—Differs from *strigosa strigosa* Wlkr. in the dark markings being brownish mouse-grey NOT dark brown, and in the pale markings being cream-coloured not dirty white; the abdomen is cream-buff NOT salmon-colour or crimson.

Hab. 2 ♂♂, New Providence Island, Bahamas, May 1922 (*F. M. St. John Yates*). (There are specimens in the British Museum presented by Mr. Yates and further ones in his own collection.)

(62) *Phryganoptera perineti*, sp. n.

♂.—Similar to *saalmüller*i Rothsch., but much larger, the tone of the ground-colour much less ochreous, and

the hind wings semivitreous grey and uniform, NOT with basal third ochraceous. Dark markings on fore wings similar, but more strongly defined.

♀.—Has dark markings very intense and hind wings uniform mouse-grey with nervures brown. Both sexes have head and patagia cream-colour not grey.

Fore wing, ♂ 25 mm., ♀ 27 mm. Expanse, ♂ 54 mm., ♀ 60 mm.

Fore wing (*saalmülleri*), ♂ 19 mm., ♀ 22 mm. Expanse, ♂ 42 mm., ♀ 49 mm.

Hab. 2 ♂♂, 1 ♀, Station Perinet, 149 km. east of Tananarivo, 20 Oct. to 10 Nov., 1930 (*Mme N. d'Olsouffieff*).

(63) *Teracotona neumanni*, sp. n.

♂.—Legs and pectus sooty blackish grey, fore coxæ yellow, antenna black, head and thorax blackish brown-grey with two yellowish spots on collar, abdomen crimson. Fore wings sooty blackish grey reticulated and strigulated with white. Hind wings rose salmon-colour, a black discocellular stigma.

Fore wing 24 mm. Expanse 54 mm.

Hab. Kambatta, S.W. Abyssinia, 1st May, 1925 (*Oscar Neumann*).

(64) *Teracotona senegalensis*, sp. n.

♂.—Pectus brown-grey; legs black-brown, coxæ crimson; head and thorax wood-brown; antennal three basal segments brown, rest black; abdomen crimson, two dorsal rows of black spots. Fore wings deep reddish brown, almost completely suffused with sooty brown-black. Hind wings rose-crimson, a large arrow-head stigma joined on to an irregular very broad submarginal band black.

Fore wing 22 mm. Expanse 50 mm.

Hab. 1 ♂, Sédhiou, Sénégal, 1917 (*H. Castell*).

(65) *Teracotona kenya*, sp. n.

♀.—Pectus, legs, head, and thorax sooty black; antennæ grey-black; abdomen black above, and below dark greyish brown on the sides. Fore wings dark grey, a number of irregular and more or less defined transverse lines and bands black, indistinctly outlined

in greyish yellow, a large black patch in and beyond the cell, fringe black notched with yellow. Hind wings greyish buffy white with stigma and three marginal spots sooty grey.

Fore wing 15 mm. Expanse 34 mm.

Hab. 1 ♀, Hoey's Bridge, Kenya Colony (*Captain Pitman*).

(66) *Teracotona pitmani pitmani*, sp. n.

♀.—Pectus dull yellow; legs, head, and thorax sooty grey-brown; antennæ black; abdomen dull yellow with lateral and two dorsal lines of black spots. Fore wings grey freckled with dull yellow, a small discocellular stigma and a postdiscal spot black. Hind wings buffy yellow, stigma and several marginal spots black.

Fore wing 19 mm. Expanse 43 mm.

Hab. 1 ♀, Hoey's Bridge, Kenya Colony (*Capt. Pitman*).

(67) *Teracotona pitmani major*, subsp. n.

♀.—Much larger than *P. pitmani*, fore wings more densely freckled and with a brownish-yellow tinge; hind wings with a distinct rosy suffusion; basal segment of abdomen pale rose. ♂ apparently similar, but much rubbed and unmeasurable.

Fore wing, ♀, 26 mm. Expanse 59 mm.

Hab. 1 ♀, Nr. Nairobi, 5650 ft., Kenya Province, April 7th, 1915; ♂, Nairobi, Nov. 1927 (*Mrs. D. M. Hopkins*).

(68) *Secusio drucei*, sp. n.

♂.—Differs from *mania* Druce in the veins of the outer half of the fore wings being much more sharply picked out in brown and more widely coloured, also in the brown bands on each side of the veins in basal half of fore wings being wider and more distinct. The outer fourth of fore wing forms a distinct chocolate-brown apico-subapical curved band, whereas in *mania* this band is indistinct, irregular, and obscure. Hind wing differs in the marginal spots at end of nervures being larger and more or less coalescing into a marginal band. ♀ similar to male, and shows some differences from *mania*, but is larger and has distinct complete marginal band of chocolate-brown to hind wings.

Fore wing, ♂ 22 mm., ♀ 24 mm. Expanse, ♂ 25 mm., ♀ 27 mm.

Hab. 3 ♂♂, 6 ♀♀, Bange, Ngola, Angola, 7 Oct., 1903 (*Dr. Ansorge*) (type); 1 ♂, Sokoke, nr. coast, British East Africa, Jan. to Feb. 1921 (*W. N. van Someren*); 1 ♂?, 4 Oct., 1903.

(69) *Secusio drucei intensa*, subsp. n.

♂.—Differs from *d. drucei* in the basal half of the fore wings having the intraneural brown bands entirely coalesced, the veins only showing yellow; the outer half of fore wings has the apico-subapical chocolate-brown band wider, so that the semivitreous white colour is reduced to a broad oblique band; ♀ similar, hind wings in both sexes rufous-orange with complete marginal band.

Hab. 4 ♂♂, 3 ♀♀, Fajao, Unyoro, June and July 1897 (*Dr. Ansorge*).

(70) *Secusio monteironis*, sp. n.

♂.—Pectus white with two black streaks; palpi orange below, black above; head orange with central dot, antennæ black; patagia orange with central black spot; tegulae and thorax black with white borders and bands; abdomen orange with dorsal row of small black spots. Fore wing cream-colour, veins and central longitudinal line in cell chocolate-brown, a patch of chocolate brown extends from costa to median nervure across centre of cell. Hind wings cream-colour suffused with yellow, outer two millimetres yellow, nervures brown towards the tips.

Fore wing 23 mm. Expanse 50 mm.

Hab. Delagoa Bay (or Angola) (*Mrs. Monteiro*). Doubt caused by labels getting mixed.

(71) *Secusio ansorgei*, sp. n.

♂.—Nearly allied to *strigata* Walk. Pectus grey-brown; palpi orange, last joint white and black; head and patagia orange with central black spots; tegulae dull orange, central band black; thorax wood-brown; abdomen above pale wood-brown, sides orange with rows of minute black dots. Fore wing greyish wood-brown with oblique band of four

white spots. Hind wing dull greyish yellow, veins, stigma, and broad margin dirty greyish wood-brown.

Fore wing 18 mm. Expanse 38 mm.

Hab. 1 ♂, Pedreira, Bihé, Angola, Nov. 12, 1904
(*Dr. Ansorge*).

(72) *Rhodogastria abdominalis*, sp. n.

♂.—Similar to *eugenia*, only larger and the black spots much more conspicuous. Pectus white with two black dots; legs crimson, coxæ washed with grey; head white, a black dot on frons and on vertex; patagia, tegulæ, and thorax white with fourteen black spots; abdomen white with cream suffusion and lateral rows of black dots.

Fore wings semivitreous white with two basal black spots, central area of disc almost vitreous, apical fourth pale cinnamon. Hind wing semivitreous white.

Fore wing 25 mm. Expanse 56 mm.

Hab. 1 ♂, caught at sea, Straits of Malacca.

(73) *Migoplastis philippinensis*, sp. n.

♂.—Differs from *alba* Moore in being larger, and the wings are much broader and semivitreous, also differs in having veins of fore wings brown. Bands on abdomen narrower and intense black, not black-brown; anal tuft cream-colour, not orange-buff. Hind wing normal, not abruptly concavely truncated from tornus to termen. ♀ similar.

Fore wing, ♂ 28 mm., ♀ 30 mm. Expanse, ♂ 62 mm., ♀ 66 mm.

Hab. 3 ♂♂, 1 ♀, Haight's Place, Panai, Pr. Benguet, Luzon, 7000 ft., Nov. to Dec. 1912 (*A. E. Wileman*).

(74) *Ilemodes heterogyna astrigoides*, subsp. n.

♀.—Differs from *astriga* Hmps. in the absence of the yellow costa of fore wing and much larger and broader wings.

♂.—Differs from ♂ of *heterogyna* in having silvery-grey fore wings strongly saturated with wood-brown, a white band along vein 1 below it and a broad black-brown band above it. Hind wing yellowish buff not orange-yellow.

Fore wing, ♂♀, 23 mm. Expanse, ♂♀, 50 mm.

Hab. 15 ♂♂, 8 ♀♀, escarpment, British East Africa, March 1901 (*W. Doherty*) (♀ type).

(75) *Neidalia orientalis*, sp. n.

♂♀.—Nearest to *villacresi* Dogn., but at once distinguishable by the absence of the white marking along the black transverse line of the fore wings, the different ground-colour, and the narrower wings.

♂.—Legs, tarsi black ringed with yellow, tibiae orange, coxae orange with front black; pectus, head, and thorax orange golden-yellow; abdomen orange golden-yellow, basal half washed with rose. Fore wing rose, nervures black, a black line from base along subcosta for one-third its length, an oblique transverse black line reaching from subcostal to inner margin one-fourth from base of wing, a broad golden-yellow margin all round wing. Hind wing rosy salmon-colour, fringe golden-yellow.

♀.—Similar but larger, and has the tegulae with median stripe salmon-colour, the abdomen with dorsal line of black spots and large buffy-white anal tuft.

Fore wing, ♂ 18 mm., ♀ 22 mm. Expanse, ♂, 42 mm., ♀ 51 mm.

Hab. 10 ♂♂, 3 ♀♀, Alto da Sierra, São Paulo, June-July 1921-1929 (*R. Spitz*).

(76) *Acantharctia antemediata*, sp. n.

♂.—Pectus grey with two darker marks; antennae black; head and thorax white, tegulae with a black basal spot; abdomen yellow with black dorsal transverse bands and a row of lateral black dots, basal segment and anal tuft white. Fore wing semivitreous white, a curved transverse antemedian band of four longitudinal black spots. Hind wings semivitreous white.

Fore wing 21 mm. Expanse 47 mm.

Hab. 1 ♂, Tambura, Southern Bahr-el-Ghazal.

(77) *Acantharctia lacteata*, sp. n.

♂.—Pectus, head, and patagia yellowish buff; rest of thorax cream-colour; abdomen golden-yellow with traces of black spots dorsally (some of the ♂♂ have black dorsal bands). Fore wing cream-colour, fringes

and costa deeper yellowish buff. Hind wings semivitreous cream-colour, tornal area and fringes buff. ♀ differs in both fore and hind wings being semivitreous cream-colour, terminal fringes only being buff, in the abdomen having broad black transverse bands, and in being much larger.

Fore wings, ♂ 18 mm., ♀ 24 mm. Expanse, ♂ 41 mm., ♀ 54 mm.

Hab. 7 ♂♂, 5 ♀♀, Sédhiou, Sénégal, May to Oct. 1917 (*H. Castell*); 3 ♂♂, Bingerville, Ivory Coast, Sept. 1915 (*G. Melou*); 1 ♂, Zomba, Nyasa, July-Aug. 1925 (*H. Barlow*).

XXII.—*Descriptions of Three new Species of Formicidæ, and a Synonymical Note.* By HORACE DONISTHORPE, F.Z.S., F.E.S., &c.

PONERINÆ.

Pachycondyla (Ectomyrmex) striolata, sp. n.

♀.—Black, mandibles, antennæ, edges of lobes of frontal carinæ, legs, posterior borders of segments of gaster, fifth segment, and sting red. Body clothed with short scattered hairs, which are longer and closer on the gaster. Head strongly and somewhat deeply longitudinally striate, the striæ of the rather flat surface of the head and of the cheeks meeting behind the temples; mandibles shining, faintly longitudinally striate, with scattered punctures, and a row of punctures along the terminal borders; clypeus narrow, rounded at apex, slightly striate; frontal furrow deeper posteriorly; antennæ thickened towards apex, the penultimate joints transverse, last joint about as long as the two preceding taken together. Thorax strongly striate, circularly on pronotum, longitudinally on dorsum and sides, and transversely on the declivity of the epinotum. Node of petiole smooth on upper surface, transversely striate on anterior surface, and more faintly so on posterior surface. Gaster smooth and shining, but under a high power very finely, closely, and shallowly studded with very small punctures. Legs covered with close decumbent pubescence. Long. 7.3 mm.

Described from two specimens taken by S. W. Chatterjee in fungus at Dehra Dun, March 4th, 1922.

Type in Coll. Brit. Mus.

MYRMICINÆ.

Ocymyrmex carpenteri, sp. n.

♀.—Rufo-piceous, head, antennæ, tarsi, spurs, and articulations of the legs with the body more reddish, gaster black. Body clothed with scattered longer and shorter bristles, legs with longer and closer semidecumbent bristles. The mandibles furnished beneath with long curved hairs extending downwards and backwards; a bunch of three or four long curved hairs at the base of the mentum, extending forwards.

Head broad, transverse, truncate in front, rounded at sides and base, longitudinally striate along the front between the frontal carinæ and along the cheeks, the striæ, which are deep and close, continuing transversely around the temples and occiput, hair-bearing punctures occur at intervals in the striæ; *mandibles* deeply and strongly longitudinally striate, with hair-bearing punctures inserted in the striæ, with five teeth, the apical one long and pointed, the anti-penultimate longer than the rest; *clypeus* convex, extending over the mouth, rather broadly and deeply excised in the centre of anterior border, with faint somewhat widely separated longitudinal ridges, a row of large round hair-bearing punctures on anterior border, and a few scattered ones on disc; *frontal area* small, triangular, shining, with small ridges arranged along the posterior borders; *frontal carinæ* strong, with raised lobes divergent behind; *front* with a small shallow puncture in centre, and a deeper one a little behind it; *antennal foveæ* large and deep; *eyes* large, somewhat oval and projecting, placed rather far back on the head; *antennæ* long, *scape* extending a little beyond the occiput, *funiculus* with all the joints longer than broad, 1st joint as long as the 2nd and 3rd together. *Thorax* contracted in middle, the sutures rather less faintly indicated at the sides than usual in *Ocymyrmex*, strongly transversely striate throughout, except the sides of the *epinotum*, which are longitudinally striate, hair-bearing punctures are inserted in the striæ. *Petiole* long, the *peduncle* long, and slender towards base,

transversely striate, with small hair-bearing punctures in the striæ, the base of the peduncle less strongly striate than the apex, the latter more so than the node, the interstices of the striæ of the *node* are somewhat coriaceous; *post-petiole* a little broader towards the apex than the node of petiole, very finely coriaceous, with small scattered hair-bearing punctures; *gaster* with first segment slightly subpedunculate, the whole gaster smooth and shining, but under a high power very finely coriaceous, with small scattered hair-bearing punctures, the first segment marked with a few faint transverse furrows. *Legs* long. *Long.* 11 mm.

Type in Coll. Brit. Mus.

Described from a worker taken by Dr. G. D. Hale Carpenter in South Africa, Bechuanaland, Ngamiland, Nov. 1930–Jan. 1931.

This species is larger than all the other known species, except *O. picardi* Forel, from which it differs in colour, punctuation, etc.

FORMICINÆ.

Camponotus (Myrmotrema) lamborni, sp. n.

♀ major.—Black, somewhat shining, base of scape, last two joints of anterior and intermediate tarsi, strigils, and spurs reddish. Body clothed with long erect scattered yellow hairs, more abundant on gaster, and little golden adpressed hairs, the gaster with longer and closer decumbent greyish pubescence.

Head transverse, wider behind than in front, sides evenly rounded, posterior border slightly excised, the whole of the surface covered with fine coriaceous puncturation, and coarse fairly large foveolate punctures are scattered unevenly about, more abundant on the mandibles, cheeks, clypeus, between the frontal carinæ, temples, and round the eyes, bare spaces, except for the surface-puncturation, occur outside the frontal carinæ and on the occiput; *mandibles* with six rather large smooth and shining teeth, the apical one distinctly longer than the rest; *clypeus* somewhat flat, not carinate, longer than broad, slightly broader in front than behind, anterior border truncate, posterior border with a narrow but distinct suture, triangularly rounded in the middle to define the anterior part of the *frontal area*, which is

not distinctly defined behind; *frontal furrow* narrow but broadest in front; *frontal carinæ* strongly arched, divergent in front and behind; *eyes* large, rather flat; *antennæ*: *scape* considerably curved and narrower at base, reaching a little beyond the posterior angles of head, *funiculus* with all the joints elongate and subequal, except first and last which are a little longer. *Thorax* with similar surface coriaceous puncturation to that of head; declivity of *epinotum* and anterior and posterior sides of *scale* of *petiole* finely transversely striate; *promeso-* and *mesoepinotal sutures* distinctly defined; upper surface of *scale* rounded, not excised. *Gaster* with surface-puncturation considerably finer than that of head and thorax, with small widely separated piligerous punctures scattered over it. *Legs* with coriaceous surface-puncturation and larger scattered punctures, *tibiæ* flat without outstanding hairs. *Long.* 9.2 mm.

♀♀ *media* and *minor* differ from the worker major only in the smaller sizes, smaller and narrower heads, the foveolate punctures much less distinct in the *media* and almost wanting in the *minor*. *Long.* 8.8 and 6.9 mm.

♂.—Black, apex of joints of tarsi, claws, strigils, and base of antennæ reddish. Body clothed with longer and shorter erect yellow hairs and some small adpressed ones. *Head* small, triangular, whole of head with fine coriaceous surface-puncturation and traces of scattered larger punctures especially on cheeks and clypeus; *mandibles* narrow, but well developed, no teeth to terminal border; *clypeus* transverse, convex; *frontal area* ill defined; *frontal furrow* distinct, reaching median ocellus; *frontal carinæ* short, low, and ill defined behind; *eyes* very large and prominent; *ocelli* large, prominent; *antennæ* long, *scape* extending by half its length beyond the posterior angles of the head. *Thorax* with fine coriaceous surface-puncturation; *pronotum* narrow, slightly transversely striate; *scutum* of *mesonotum* flat on disc, round and convex in front; *parapeidal furrows* reaching base of scutellum and continued in a fine raised transverse ridge bordering the scutellum; *præscutellum* short, transverse, convex, with one or two round punctures on antero-lateral border; *scutellum* very convex, very smooth and shining on lower half of sides and projection of the same. *Scale* of *petiole*

low, transverse, hexagonal, rather thick, straight on anterior border, convex and finely transversely striate on anterior surface, somewhat flat and finely transversely striate on posterior surface, with two hair-bearing punctures at the corners of the two short antero-lateral sides, and a small tooth at the base of the postero-lateral sides, three or four long hairs and some shorter ones project from the sides. *Gaster* slender, shining, very finely coriaceously punctured and with small scattered piligerous punctures. Wings dusky, with pale brown veins and darker *pterostigma*. *Legs* long, *femora* somewhat flat, curved, broadest about middle, finely transversely striate, *tibiae* flat, finely punctured and pubescent, with some little golden adpressed hairs. *Long.* 7.6 mm.

Type and allotype in Coll. Brit. Mus.

Described from three ♂♂ and a number of ♀♀ taken by W. A. Lamborn in Nyassaland, Maiwale near Fort Johnston, on December 2nd, 1931.

Camponotus (Tanæmyrmex) similis, sp. n. = *Camponotus badius* Bingham (1903), nec Smith (1857).

The *Camponotus badius* described by Bingham in the 'Fauna of British India, Hymenoptera,' vol. ii., "Ants and Cuckoo-Wasps," p. 358 (1903), and said to be Smith's species, is a *Tanæmyrmex*, whereas the latter is a *Colobopsis*.

Type in Coll. Brit. Mus.

XXIII.—*Tarsonemus approximatus Banks var. narcissi Ewing* a Variety of *Tarsonemid* new to the British List. By A. M. MASSEE (Research Station, East Malling, Kent).

ON January 28th, 1932, the writer received specimens of a *Tarsonemid* mite which were found in a stock of bulbs a few days previously by Mr. W. E. H. Hodson, Entomologist, Reading University, with a request for the determination of the species.

Some time later a large quantity of bulbs infested by a species of *Tarsonemid* mite were received from Mr. Hodson, and a further supply was sent to East Malling by Mr. A. S. Buckhurst of the Plant Pathological Laboratory, Harpenden, Herts.

Mr. Hodson reported that the mite was first recorded by himself in Great Britain on January 25th in a stock of bulbs of the variety Diadem at Abingdon, Berks. This particular stock of bulbs had been in the country for a number of years, which makes it improbable that the mite is a recent import.

In the following months mite-infested stocks of bulbs were found at Penzance, Cornwall; Bromham, Wilts; Slough and Taplow, Bucks; and elsewhere—indicating that the distribution is fairly general. The infested varieties found by Mr. Hodson include the following:—Soleil d'Or, Argent, Sir Watkin, Dante, Golden Spur, Diadem, Emperor, King Alfred, and Victoria.

Mr. Hodson also states that a study of the bionomics of the mite has already been commenced, and that it is already apparent that it is responsible for the so-called "loss of vigour" in many field-stocks, and is further capable of causing complete or partial failure of the flower-crop, particularly in forced bulbs.

The mites in question were compared with other species of the same genus which occur in this country, and it was evident that the species was new to Britain.

In 1929 Mr. H. E. Ewing, of the United States Bureau of Entomology, described a new variety of *Tarsonemus* from the Pacific Coast, and it was stated that the mites were found infesting narcissus plants and bulbs, causing some injury to the same. Thus it seemed imperative to compare the English and American species of bulb-mite to determine whether they were one and the same species.

Material of the English species was sent to Dr. A. C. Oudemans, the celebrated acarologist of Arnhem, Holland, who very kindly made preparations and drawings of the mite, and later on determined the species as being *Tarsonemus approximatus* Banks var. *narcissi* Ewing.

Mr. Hodson also informs me that specimens were sent to Mr. H. E. Ewing, at Washington, who confirmed the opinion already made by Dr. Oudemans, namely, that the English and the American species were one and the same variety.

Tarsonemus approximatus Banks var. *narcissi* Ewing was described by Ewing* in a paper entitled "A new

* 'The Proceedings of the Entomological Society of Washington,' 1929, xxxi. no. 2, pp. 31-32.

Variety of *Tarsonemus* (Acarina) from the Pacific Coast." Ewing's original description of the variety is as follows :—

"*Tarsonemus approximatus* Banks var. *narcissi*, new variety.

"*Female*.—Of the type of *approximatus* Banks. Last segment of last pair of legs extending beyond the margin of the abdomen by about its length. This segment is a little over half as long as the penultimate.

"Length of female, 0.23 mm. ; width, 0.11 mm.

"*Male*.—Capitulum almost circular. Posterior cephalo-thoracic bristles rather short and spine-like, in length equal to one and a half times the width of coxa II. Posterior lateral setæ of abdomen spine-like, not equal



Tarsonemus approximatus Bks. var. *narcissi* Ewing. \times about 610.

I. Right leg iv. of ♀ from below.
II. Left leg iv. of ♂ from below.

to femur IV. in length. Last pair of legs longer and stouter than the third pair ; coxa somewhat triangular, as broad as long and without seta ; femur longer than all the other segments taken together, swollen laterally and slightly emarginate on the inner border at the insertion of inner distal seta, which is straight and equal to the width of the femur in length, lateral seta of femur curved and reaching to the tip of the segment. Distal segment of last pair of legs slightly longer than broad, inner spine at tip of segment and about one-third as long as tarsal claw, outer seta clavate, situated almost at tip of segment and half as long as tarsal claw, ventral

seta straight, slightly longer than tarsal claw and slightly surpassing the same; tarsal claw stout, slightly shorter than the last segment of the leg.

"Length of male, 0.16 mm.; width 0.09 mm."

The bulb *Tarsonemid* mite is very similar in appearance to other members contained in the genus, and the determination of the variety can be made only after careful comparisons with the aid of a compound microscope. The chief characters for the determination of the variety are based on the number, formation, and position of bristles on the fourth pair of legs of the ♂; this applies in a lesser degree also to the ♀. The structure of the terminal claw of fourth pair of legs of ♂ also assists in obtaining a correct determination. The figure, showing the formation of the left hind leg of ♂, has been prepared by Dr. A. C. Oudemans and the present writer—the drawing of the hind leg of ♀ being the work of Dr. A. C. Oudemans.

The species *Tarsonemus approximatus* Banks has not yet been recorded in this country, but only the variety as referred to above.

The writer is greatly indebted to Dr. A. C. Oudemans for his help in the determination of the variety.

SUMMARY.

The mite, *Tarsonemus approximatus* Banks var. *narcissi* Ewing; a variety of mite hitherto unrecorded in this country has been found infesting stocks of bulbs. The mite has been detected on nine varieties, and its distribution appears to be fairly general.

The original description of the mite as described by Ewing together with drawings of the hind legs of ♂ and ♀ are given.

XXIV.—*A new Species of Gall-mite from South India.*

By A. M. MASSEE (Research Station, East Malling, Kent).

[Plate V.]

A new species of gall-mite, which produces very characteristic galls upon the foliage of *Pongamia glabra* Vent., was sent to East Malling for determination during September 1930 by Mr. M. C. Cherian, Assistant

Entomologist, Agricultural Research Institute, Coimbatore, South India.

According to Mr. Cherian the galls are generally found on the upper surface of the leaves. Occasionally they are found on the lower surface also. The entrance to the galls in the former case is on the upper surface and in the latter case on the lower surface. The openings are covered with fine white hairs in the early stages of development, and when the galls mature the hairs turn a dark brown colour. The galls are green in colour. The hairy formations inside the galls are white at first, and then change to dark brown later on. Galls are found on the leaves in large numbers (see Pl. V.). The galls vary in size, the largest one being noted at present measuring $11 \times 4\frac{1}{2}$ mm.

The tree, *Pongamia glabra* Vent., upon which the mites occur is found in most districts of the Madras Presidency. It is often planted in gardens and avenues. The seeds of the tree yield an oil which is used for illuminating and medicinal purposes, while the leaves are used as a green manure.

The mites causing the galls have been collected from the Coimbatore and Bellary districts, but it is quite probable that they occur in other parts as well.

The degree of infestation is sometimes so severe that the majority of the leaves on the trees are affected.

The cause of the gall proved to be a species of Eriophyidae, and contained in the genus *Eriophyes*. The species was unknown.

It is proposed to name this new species *Eriophyes cheriani*, sp. n.

The type-vial will be deposited in the East Malling Collection.

The species is fully described below, together with localities, host-plant, etc.

Eriophyes cheriani, sp. n.

Body cylindrical, narrowly tapering at caudal end. It is long, and is strongly punctated on dorsal and ventral surfaces. Thoracic shield semicircular, $30\ \mu$ broad. Projecting over rostrum. Shield much ornamented; with three longitudinal furrows in middle, marking at sides of shield not so conspicuous, short and curved. Thoracic

bristles situate at or near lateral edges of shield, a posterior margin. Thoracic bristles strong and well developed; directed upwards and outwards (occasionally directed towards caudal end) $18\ \mu$ long. Warts of thoracic bristles large and well formed.

Rostrum strongly curved, completely covered by thoracic shield. Legs small and frail. First pair of legs $26\ \mu$ long; second pair $20\ \mu$ long, fourth and fifth joints $14\ \mu$ long. Tarsal bristles $14\ \mu$ long. Claws of second pair of legs $8\ \mu$ long. Feathered claw well developed, 4-rayed.

Sternal ridge simple, conspicuous. First pair of coxal bristles well developed, situate before anterior end of sternal ridge; second pair stout, tapering, a little before basal end of sternal ridge; third pair in line with inner coxal angle, robust, short, $18\ \mu$ long.

Abdomen narrowly ringed, there being about 80 rings—the anal rings being the broader. Dorsum and venter strongly punctate. Lateral bristles in line with the centre of the epigynium, $34\ \mu$ long. First pair of ventral bristles strongly acuminate, $32\ \mu$ long; second pair weak, not conspicuous, $12\ \mu$ long, third pair $40\ \mu$ long? Anal lobe smooth, $10\ \mu$ broad. Caudal bristles thread-like, $58\ \mu$ long. Accessory bristles absent. Epigynium $20\ \mu$ broad. Cover-flap conspicuous and marked with pronounced longitudinal lines. Genital bristles directed towards base, very short and strong, $11\ \mu$ long.

♀.— $160\ \mu$ long, $30\ \mu$ broad. ♂ unknown.

Host-plant.—*Pongamia glabra* Vent.

Producing conspicuous cephaloneon or “pouch-shaped” galls on the upper surfaces of the leaves, occasionally on the under surfaces of leaves also. The galls sometimes attain the length of nearly half an inch, and a large number occur on a single leaf. The galls are green in colour.

Distribution.—Coimbatore and Bellary districts, South India (M. C. Cherian).

EXPLANATION OF PLATE V.

Pongamia glabra Vent. : showing (left) normal foliage; (right) galls produced by the gall-mite, *Eriophyes cheriani*, sp. n.

XXV.—*Descriptions and Records of Bees.*—CXLI.

By T. D. A. COCKERELL, University of Colorado.

Epeolus amabilis Gerstaecker.Natal: Greytown, Oct. 20, ♂ (*A. M.*).*Epeolus glyptochilus* Bischoff.Natal: Amanzimtoti, Oct. 16, ♀ (*J. O.*).

This agrees sufficiently with Bischoff's too brief description.

Scapter macrocephala, sp. n.

♀.—Length 8.5 mm.

Black, including mandibles; flagellum dusky rufous beneath except at base; tegulae dark brown with hyaline margin; wings hyaline, stigma and nervures rufous; head very broad, face with much white hair; clypeus broadly depressed in middle, strongly and quite closely punctured on a shining ground; labrum with red hair; cheeks shining; front striate; ocelli in a slight curve; scape punctured; flagellum minutely and very briefly hairy; third antennal joint longer than fourth, but not as long as fourth and fifth together; blade of maxilla short (about 325 microns from palpus to end), broad, obtuse, with five bristles at the tip; inner comb well developed; maxillary palpi 6-jointed, stout, dark, with the apex pale rufous; when extended they go a little beyond the maxilla; joints measuring in microns about (1) 68, (2) 112, (3) 50, (4) 38, (5) 38, (6) 75; labial palpi extremely short, first joint very stout (about 82 microns long and 50 wide), the other three smaller and subequal; thorax with greyish-white hair, abundant on sides; mesothorax shining, with strong not very dense punctures, and a distinct median groove; scutellum shining, with scattered punctures on disc; area of metathorax dull, but the adjacent sides shining; middle of mesopleura dull and rough. Basal nervure almost straight, falling considerably short of nervulus; second cubital cell long, receiving recurrent nervures a good distance from base and apex. Legs black with whitish hair, tarsi obscurely rufescent apically, anterior tibiae red in front, middle knees red; claws with a basal denticle. Abdomen smooth and shining, weakly sculptured, without bands; apex with pale reddish hair; venter with much short whitish hair, like a short scopa.

Cape Province : Nieuwoudtville, Nov. 18 (A. M.).

The area of metathorax has delicate wrinkled plicæ, not well seen without the microscope. Another microscopical character is on the posterior margin of mesothorax, where the descending marginal area is distinctly striate. The hind legs have a distinct basal flocculus and tibial scopa and long hair on the femur. In Friese's key it runs nearest to *Polyglossa capensis* Fr. and *P. alfkeni* Fr. *P. capensis* has (♀) yellowish-brown hair, redder on thorax above, and dark hair at end of abdomen. *P. alfkeni* has the hind margins of second and following tergites pallid, and the second cubital cell receives the first recurrent nervure conspicuously nearer base than second to apex. It agrees in having a broad face. *Strandiella glaberrima* Friese has the stigma differently coloured, and the part entering the marginal cell is longer. These species of Friese are to be placed in *Scapter*.

Scapter perpunctata, sp. n.

♀.—Length 8.7 mm.

Black, including mandibles and antennæ, the flagellum faintly reddened at apex; tegulæ brownish, with broad hyaline margin; wings dilute fuliginous, stigma dusky rufous, nervures brown; head not so broad as in *S. macrocephala*, but facial quadrangle broader than long; mandibles simple, broadened subapically; clypeus shining, with very large punctures (appearing immense under microscope), well separated, and a strong median channel; supraclypeal area distinctly elevated, with a broad polished surface; front very strongly punctured; ocelli in a low triangle; labrum triangular, with a few strong dark bristles at end; maxilla and palpi similar to those of *S. macrocephala*, but the six-jointed palpi longer, the second joint conspicuously longest, about 135 microns, end of maxillary blade with many hairs; mesothorax and scutellum shining, with sparse large punctures; area of metathorax with strong radiating plicæ; mesopleura coarsely rugoso-punctate; hair of head and thorax scanty, white, brownish on vertex. Basal nervure arched, falling conspicuously short of nervulus; second cubital cell receiving recurrent nervures equally distant from base and apex; stigma large, with a large part entering marginal cell. Legs black, with pale hair, brown on hind margin of hind tibiæ; basal flocculus

and tibial scopa well developed and abdomen with a distinct, quite long, ventral scopa of white hair, which carries some pollen. Abdomen shining pure black very sparsely punctured, without bands; hair at apex dark grey; a marked constriction between first and second tergites.

Cape Province: Knysna, Nov. 6 (*J. O.*).

By the large separated punctures on mesothorax this resembles *S. caffra* (Br.), but that has a dark tibial scopa. There is also much resemblance to *S. glaberrima* (Fr.) and *S. fuscipennis* (Fr.), but those have the tibial scopa fulvous (blackish brown above). The wings are much darker than in *S. glaberrima*, which I have from Montagu, C.P. (*Turner*). *S. fuscipennis* I only know from Friese's brief account; it is a large bee, 10 mm. long, the legs with fulvous hair.

Scapter pallidicincta, sp. n.

♂ (type).—Length about 6 mm.

Black, slender, brilliantly shining; mandibles black; face narrow, covered at sides (but not on clypeus) with dense pure white hair; clypeus coarsely but not densely punctured, with a deep smooth median channel; supra-clypeal area shining; flagellum thick, clear reddish orange beneath; hair of thorax white, but extremely scanty; mesothorax shining, with well-separated large punctures and five strong grooves; scutellum small, shining; area of metathorax very large, triangular, rough and dull, basally with longitudinal plicæ, but beyond these with irregular transverse plicæ; margin of area glistening, crossed by little plicæ; sides of metathorax shining; tegulæ brown with hyaline margins. Wings strongly reddened, with a large very dark stigma and dark nervures; basal nervure strongly arched, falling short of nervulus; second cubital cell receiving recurrent nervures about equally distant from base and apex. Legs slender, black; anterior tibiæ ferruginous in front; a small yellow spot on front and middle knees. Abdomen subclavate, polished, with scattered strong punctures and excessively minute ones between; margins of tergites brownish; entire bands of greyish-white hair at bases of second and third tergites; first tergite large, strongly convex in lateral profile, the suture between it and second depressed.

The dull area of metathorax, with longitudinal and

transverse plicæ, producing in the middle a sort of network, is very different from that of the female.

♀.—Length about 6.6 mm.

More robust than male, but still a slender insect; clypeus swollen, shining, strongly but very sparsely punctured, with a very deep median groove; flagellum dull rufous beneath except at base; mesothorax with very sparse strong punctures and three grooves; area of metathorax rough with plicæ at base, but the apical half or more smooth and shining; posterior face of metathorax shining at sides, in middle depressed and dull; first tergite not modified, not especially convex in profile; only one evident greyish band, at base of fourth tergite; apical hair thin, pale, with a brownish tint; a pale fringe (which collects pollen) on apex of second sternite; hind legs with good pollen-collecting scopæ on trochanters, femora, and tibiæ, the hairs of tibial scopæ dull whitish. Mouth-parts (measurements in microns): blade of maxilla with outer half dark brown, inner pale reddish; length from palpus to end 312, apex with about ten bristles; maxillary palpi longer than blade, 6-jointed, the joints measuring (1) 62, (2) 183, (3) 62, (4) 58, (5) 53, (6) 82; labial palpi with joints measuring (1) 125, (2) 75, (3) 70, (4) 88. These measurements are, of course, only approximate, and not accurate down to a micron.

Cape Province: near Oudtshoorn, Nov. 1 (*L. O.*).

A distinct little species, with a surprising difference in the thoracic sculpture of the sexes. It is related to *S. caffra* Brauns, but that lacks the grey bands on abdomen and has the male face covered with white hair. As *S. caffra* appears only to be known from the very brief characters given by Friese in his table (1924), I give some details from a male collected by Brauns at Willowmore, and now in the American Museum of Natural History.

S. caffra.—Smaller than *S. diversipes* Ckll.; flagellum orange beneath; wings reddish fuliginous; lower section of basal nervure strongly arched, falling short of nervulus (meets nervulus in *S. diversipes*); second cubital cell large, receiving recurrent nervures about equally distant from base and apex; face covered with dense pure white hair; mesothorax shining, with sparse large punctures and broad deep median sulcus; tegulæ brown; abdomen dark coffee-brown.

S. ruficornis Ckll., 1916, which I have from Matjesfontein (Turner), is nearly the same, but has darker, less reddish wings and black abdomen. Perhaps *S. caffra* is no more than a race of *S. ruficornis*.

Halictus chalybæus Friese, 1908.

Belgian Congo : Tshibinda, Aug. 27, ♀ (*J. O.*).

A beautiful species, previously known from Kilimandjaro.

Megachile melliferina Cockerell.

Belgian Congo : males, Elisabethville, Sept. 11 (*J. O.*) ; Tenke (*Ckll.*).

Described from Natal.

Megachile rhodotrichura, sp. n.

♂.—Length 9.5 mm., anterior wing almost 7.

Black, including mandibles and the long slender antennæ ; eyes purplish black ; head round seen from in front ; face covered with dull white hair, top of head with brownish black ; cheeks with long dull white hair below ; vertex dull and very densely punctured ; mesothorax shining but closely punctured, scutellum shining anteriorly ; hair of thorax above rather short, pale fulvous, more brownish on mesothorax ; metathorax with very pale fulvous-tinted hair, mesopleura with the same above but below dull white ; tegulæ bright ferruginous. Wings pale orange, with a dusky outer margin ; stigma and nervures light ferruginous, the nervures on the dusky part dark ; basal nervure falling short of nervulus, second cubital cell receiving recurrent nervures equally distant and not far from base and apex. Legs with short pale hair, fulvous on inner side of tarsi ; anterior tarsi simple and coxæ without spines ; legs reddish black, the anterior femora in front and their tibiæ beneath clear rufous ; knees more or less red and tarsi red at end ; no modified hair on tarsi. Abdomen rather short, nearly parallel-sided, shining, the keel of sixth tergite with a pair of small low tubercles, and emarginate between. Abdomen dorsally with thin red hair, but forming dense bright red bands on tergites 1 to 4, and fifth densely covered all over with bright red tomentum ; sixth tergite vertically descending in profile, minutely and densely punctured,

thinly hairy ; venter obscurely reddish, suffused with yellowish at sides of fourth sternite ; fifth sternite broadly angulate in middle, with a single shining point ; no sub-apical teeth.

Belgian Congo : Katanga Mission, Sept. 17 (*L. O.*).

This and the next species have the aspect of *M. pachingeri* Friese, but are smaller, with the structure of the abdomen different.

Megachile fuscicauda, sp. n.

♂.—Length about 9 mm., anterior wing 7.5.

Black, including mandibles and the long slender antennæ ; face with white hair, upper part of front with brown, vertex with rufous ; eyes purplish black ; vertex densely punctured, but somewhat glistening ; mesothorax shining, but closely punctured ; hair of thorax white, dorsally greyish, with a faint fulvous tinge on shoulders, no dark hairs intermixed ; tegulæ rather small, light ferruginous. Wings dilute orange, with a broad dusky margin, stigma and nervures as in the preceding species. Legs brown, the femora distinctly reddish and the tarsi red at end ; anterior legs simple. Abdomen like that of *M. rhodotrichura*, but considerably broader, the apical tubercles (on sixth tergite) more prominent, and the fifth and sixth tergites covered with long coarse brownish-black hair, the fifth without any of the dense red tomentum, but the fourth red-haired and with a band, like those before ; venter like that of *M. rhodotrichura*. But for the entirely different pubescence of the fifth tergite one might hesitate to call this and the last distinct species.

Angola : Lobito Bay, at flowers of *Helianthus annuus*, July 20 (*W. P. C.*).

Megachile pulchrifrons, sp. n.

♂.—Length about 9 mm., anterior wing 5.7.

Black, including mandibles and the long slender antennæ, except that flagellum is obscurely brownish beneath ; eyes pea-green ; face and front densely covered with ferruginous hair, mostly very bright, but appressed and very pale over clypeus ; vertex and upper part of cheeks with pale red hair, but lower part of cheeks with pure white, and a white spot on mandibles ; vertex dull, excessively densely and finely punctured ; mesothorax

dull, scutellum a little glistening between the very dense minute punctures; hair of thorax above and region just below wings light red, thin and short on disc, dense and bright red anteriorly and on shoulders; tegulæ testaceous; thorax beneath with pure white hair. Wings hyaline, not at all yellow, the outer margin faintly dusky; stigma very small, light red; nervures fuscous, basal nervure meeting nervulus; second cubital cell receiving recurrent nervures about equally distant from base and apex. Legs black, with the anterior and middle femora red in front, middle and hind tarsi red at end; anterior tarsi red, the basitarsi little broadened, but hollowed and boat-shaped, with a pale yellowish fringe behind; anterior trochanters and base of femora with dense pure white hair, but on rest of femora it is slightly yellowish; anterior coxæ without spines; middle tarsi with silvery-white hair; hind tibiæ behind with a line of pale yellow hair, which broadens apically; hind basitarsi posteriorly with a line of pure white hair. Abdomen shining black, finely and closely punctured, the first four tergites with entire bright red hair-bands, at sides of first broadened, with much long hair; fifth tergite with a narrow rufous margin, but no hair-band, and its surface with much long black hair, which appears reddish in some lights; upper face of sixth tergite bare in middle, but at sides and extreme base covered with dense appressed bright orange-fulvous hair; transverse apical keel with a very deep broad rounded emargination, bounded on each side by a black spine, and the margin laterad of these with one or two short spines; venter simple, with rufo-fulvous hair-bands.

Angola: Lobito Bay, July 20 (*Ckll.*).

This falls in my key to males as follows:—

- | | |
|---|-------------------------------|
| Anterior basitarsi conspicuously marked with black and white, the black in the form of a large rounded patch; hair of anterior tarsi abundant and pure white..... | <i>larveisignata</i> Ckll. |
| Anterior basitarsi not so marked | 1. |
| 1. Hair of face bright orange-ferruginous; eyes green; incision of sixth tergite rounded, bounded by long spines..... | <i>pulchrisfrons</i> , sp. n. |
| Hair of face and eyes otherwise; a conspicuous brush of dense white hair on under side of mandibles | <i>multiferina</i> Ckll. |

Gronoceras holorhodura, sp. n.

♀.—Length about 18·5 mm., anterior wing 14·4.

Black, including mandibles, antennæ, and legs; facial quadrangle square; mandibles rather narrow, with two strong teeth and a broad low lamella representing the third; clypeus elevated in middle, with a strong shining keel, the surface densely punctured but glistening, the apical margin simple, with a faint suggestion of crenulation; clypeus with long black hair; front, vertex, sides of face, and cheeks with red hair; long black hairs below base of mandibles; mesothorax and scutellum dull and minutely rugoso-punctate; thorax densely covered with bright fox-red hair; tegulæ red. Wings yellowish hyaline, with broad dusky outer margin; stigma and nervures dark brown; basal nervure falling short of nervulus; second cubital cell long, receiving second recurrent nervure nearer to apex than first to base. Legs stout, with mostly red hair, but black on outer side of middle basitarsi; anterior and middle tibiæ with a long outstanding spine at end; hind basitarsi not broadened. Abdomen above and below densely covered with very bright red hair, without any evident bands; a few black hairs at end of last sternite.

Belgian Congo: Tenke, July 30 (J. O.).

Close to *G. cincta* (Fab.), so that at first I thought it might be only a variety of that species, but easily known by the dense red hair covering abdomen.

The next species, *Megachile mimetica*, is so similar in appearance that it could well be supposed to be its male; but it is not a *Gronoceras*, and the venation of the hind wing is different, as follows:—

Nervellus strongly bent in middle; externo-medial nervure from nervellus to cubital nervure considerably less than from cubital to intercubitellus, which is very oblique	<i>G. holorhodura</i> .
Nervellus not strongly bent; externo-medial nervure from nervellus to cubital nervure equal to the part from cubital to intercubitellus, which is shorter and less oblique	<i>M. mimetica</i> .

Megachile mimetica, sp. n.

♂.—Length about 15 mm., anterior wing 10·5.

Black, including mandibles, antennæ, and legs; anterior tarsi very stout, red on outer side, but not otherwise

modified; anterior coxæ without spines. Face broad, densely covered with fulvous hair, and long hair of the same colour on under side of head; some long brown hair at base and sides of clypeus; vertex with fulvous hair; clypeus dull, finely roughened, with no median keel or smooth line; vertex dull; scape short, flagellum very long and slender, the last joint expanded; thorax densely covered with fulvous hair, mesothorax and scutellum dull; tegulæ dark brown. Wings yellowish hyaline, suffused with dusky apically; nervures and stigma brown; basal nervure falling just short of nervulus; second cubital cell receiving second recurrent nervure much nearer apex than first to base. Legs stout, all the tarsi very short; femora with fulvous-tinted hair beneath; on front legs there is a very dense mass of light brownish hair on the trochanters and about basal two-fifths of femora, abruptly giving way to the sparse long hair beyond. Abdomen above very densely covered with bright red hair, without the appearance of bands; keel of sixth tergite short and broadly rounded, with a broad shallow emargination in middle and a thorn-like tooth at each extreme side; venter with pale reddish hair, margins of sternites rufous.

Belgian Congo: Katanga Mission, near Elisabethville, Sept. 17 (J. O.).

There is a strong resemblance to *M. edwardsiana* Friese, from the Transvaal, known only in the female.

Megachile (Creightonella) laminicauda, sp. n.

♂.—Length about 16.7 mm.

Long and parallel-sided, black, including mandibles, antennæ, and legs; mandibles very broad at base, with a large tooth below; clypeus extremely densely and finely punctured, but glistening, without any smooth line or keel; facial quadrangle longer than broad; face (except middle of clypeus, perhaps denuded) and front covered with very pale brownish-tinted hair; vertex with scanty dark reddish-brown hair; cheeks below with abundant long pure white hair; flagellum rather thick; mesothorax and scutellum dull and very densely punctured; sides and hind part of thorax with very abundant long pure white hair; mesothorax with scanty very pale brownish hair; tegulæ reddish brown. Wings hyaline, with the apical margin broadly pale brown; nervures

dark, basal nervure falling short of nervulus. Legs with mainly white hair, but bright fox-red on inner side of tarsi; middle tibiae with red hair on inner side; anterior tarsi simple. Abdomen shining, first tergite above and at sides with long white hair; tergites 2 to 5 with lateral white hair-bands, on 2 reduced to spots, on 5 most extensive, thin'y continued across middle; sixth tergite seen from above a large quadrate plate, the basal half with appressed greyish-white hair, but also erect black hair (much black hair on disc of fifth tergite), the centre with a keel running to the margin, which is broadly truncate, jagged with about six teeth, the innermost largest; seventh tergite with a broad apical angle or point, and in lateral profile presenting two dentiform angles, separated by a wide concave space; sternites, except on basal part of abdomen, broadly margined with deep red; fourth with four long similar slender spines; fifth with a pair of widely separated erect spines.

Belgian Congo: Dilolo, July 26 (W. P. C.). Dilolo in all these papers refers to the vicinity of Dilolo railway station, the original town of Dilolo being some miles away.

This agrees very nearly with the description of *M. mandibulata* Smith, from Natal, but is much too large. I examined the type of *M. mandibulata* in the British Museum, and the end of abdomen (transverse keel of sixth tergite) is different, with four large dentiform angles. The related *M. (Creightonella) aculeata* Vachal, smaller, with margin of sixth tergite red, was taken at Tenke, Aug. 1 (W. P. C.).

From *M. gastrodonta* (kll. *M. laminicauda* is separated by the apical teeth of the abdomen being black, the middle tarsi behind with only a few long white hairs (instead of a conspicuous fringe), and the clearer wings. There is, however, so much resemblance in structure that it is possible that we have to do with a single variable species. The matter is further complicated by another male of the same general type collected by Neave in N.E. Rhodesia (Luangwa to Petauke), and received from the British Museum as *M. funebris* Rad. This male practically agrees with *M. gastrodonta*, except that the hair on the mesothorax is pale grey and the hair on the face is pale fulvous. I consider it to be *M. gastrodonta*, but it can hardly be the true *M. funebris*, described from the Cape,

and said to have the hair of face dull grey and the abdomen with white spots at sides of tergites. Thus we have a group of closely related forms, and whether they should be considered species or races cannot now be determined.

Megachile admixta Cockerell.

Belgian Congo : Dilolo, male, July 26 (*A. M.*), females, July 25–26 (*J. O.*, *W. P. C.*).

The female is new ; it varies in length from 10 mm. to 14·5, but the difference is partly due to extension of abdomen. Two have the ventral scopa white on third sternite, with at most a few red hairs at sides, but red on fourth and fifth ; one has it light red on sternites 3 to 5 ; on the last sternite it is more or less black. The mandibles have a little red hair at the tip externally. The hair on cheeks and sides of face is brilliant white, but the species differs from *M. semivenusta* Ckll., which has the ventral scopa all white at sides and the abdominal bands narrower. The great amount of variation in both sexes of *M. admixta* suggests that it represents a hybrid population, and in that case it may well be derived on one side from *M. semivenusta*. The male *M. admixta* greatly resembles *M. thomasseti clarescens* Ckll., from S. Africa, but can at once be separated by the hair on front of hind tibiæ not longer than width of tibia.

XXVI.—*Notes on Flatfishes (Heterosomata).*—IV. *A Synopsis of the Genera of the Subfamily Pleuronectinæ.* By J. R. NORMAN, of the British Museum (Nat. Hist.).

THE dextral family Pleuronectidæ may be subdivided into five subfamilies—Pleuronectinæ, Pœcilopsettinæ, Paralichthodinæ, Samarinae, and Rhombosoleinæ. The subfamily Pleuronectinæ, as here understood, represents the subfamily of that name in Regan's¹ classification of the Heterosomata after the removal of the three tropical or subtropical genera *Marleyella*, *Pœcilopsetta*, and *Nematops*. These last agree with one another and differ from all the Pleuronectinæ in having the lateral line rudimentary and scarcely apparent on the blind

¹ Ann. & Mag. Nat. Hist. (8) vi. 1910, p. 493.

side of the body and the olfactory laminæ radiating from a central rachis¹. All the Pleuronectinae are found in arctic and northern seas, and the subfamily includes a number of very important food-fishes. The species are, for the most part, well defined, but there has been considerable difference of opinion as to the generic divisions.

1. Key to the Genera.

I. Mouth large, maxillary on ocular side generally at least $\frac{1}{2}$ head; jaws and dentition nearly equally developed on both sides; vertebrae 40 to 62.

A. Maxillary at least $\frac{1}{2}$ head; teeth sharply pointed or barbed.

1. Vertebrae 49 to 62; dorsal 93 to 114, anal 71 to 89; body rather elongate; caudal peduncle slender; caudal strong, lunato.

a. Teeth mostly with barbed tips, some depressible, biserial in both jaws; gill-rakers rather long and slender; upper eye with vertical range; lateral line without curve anteriorly; vertebrae 49 to 53

1. *ATHERESTHES*.

b. Teeth all pointed, some depressible, biserial or multiserial above, uniserial below; gill-rakers short and stout; scales all cycloid.

a. Lateral line without curve anteriorly; upper eye with vertical range, the interorbital space broader than orbit; gill-rakers 10 to 12; vertebrae 62.

2. *REINHARDTIUS*².

β. Lateral line with distinct curve above pectoral; upper eye lateral, the interorbital space not broader than orbit; gill-rakers 7 or 8; vertebrae 50 to 51

3. *HIPPOGLOSSUS*.

2. Vertebrae 40 to 45; dorsal 67 to 101, anal 51 to 79; body not elongate; caudal peduncle not slender; caudal fin never lunato; teeth conical.

a. Interorbital space an obtuse ridge; supratermporal branch of lateral line, if present, without posterior prolongation; origin of dorsal above eye, anterior rays not free.

¹ For a revision of these genera, see Norman, 'Troubia, xiii, 1931, p. 421.

² = *Platysomatichthys* auct.

- a. Teeth in upper jaw uniserial.
 - * All pectoral rays generally simple; origin of dorsal above anterior part of eye; upper eye completely lateral; snout and eye-balls not scaled
 - ** Middle rays of pectoral branched; origin of dorsal above middle or posterior part of eye.
 - † Upper eye completely lateral; snout and upper surfaces of eye-balls densely scaled
 - †† Upper eye with vertical range; snout more or less scaled; eye-balls not scaled
 - β. Teeth in upper jaw biserial.
 - * Scales rather large and deciduous; all pectoral rays simple; jaws without distinct canines
 - ** Scales small, adherent; middle rays of pectoral branched; jaws with canines anteriorly.
 - b. Interorbital space flat; supratemporal branch of lateral line with a long posterior prolongation; origin of dorsal in front of eye, anterior rays a little prolonged, more or less free from membrane; teeth in upper jaw uniserial; middle rays of pectoral branched
4. HIPPOGLOSSOIDES.
5. ACANTHOPSETTA.
6. CLEISTHENES.
7. LYOPSETTA.
8. EOPSETTA.
9. PSETTICHTHYS.
10. VERASPES.
11. GLIDODERMA.
12. HYPSPSETTA.
- II. Mouth smaller, maxillary on ocular side less than $\frac{1}{2}$ head; jaws and dentition better developed on blind side.
- A. Maxillary on blind side nearly $\frac{1}{2}$ head; teeth stout, conical, in two distinct rows in both jaws; scales of ocular side (in adults) all replaced by rough tubercles, blind side quite naked ...
- B. Maxillary on blind side not more than $\frac{1}{2}$ head.
1. Teeth small, acute, in villiform bands; supratemporal branch of lateral line with a long posterior prolongation; lower pharyngeals narrow, scarcely approximated; scales all cycloid.
- a. Lips simple; origin of dorsal on median line of head

- b. Lips thick, with transverse plicae ;
origin of dorsal on blind side of
head
2. Teeth larger, obtuse, conical or
incisor-like, uniserial or sometimes
irregularly biserial.
- a. Postocular ridge sometimes rugose,
or with one or two protu-
berances, never broken up into
a series of prominences.
- a. Lower pharyngeals narrow, $4\frac{1}{2}$
to 7 times as long as broad,
rather slender, the inner edges
evenly curved and scarcely
approximated, the teeth sharply
or obtusely conical, usually in
2 rows; pyloric appendages
of moderate length or rather
long, 2 to 4 + 1 to 5.
- * Supratemporal branch of late-
ral line with a posterior pro-
longation.
- † Lateral line with low curve
above pectoral.
- ‡ Scales of ocular side
strongly ctenoid; eyes
rather small, upper
lateral; teeth conical..
- ‡‡ Scales of ocular side
mostly cycloid; eyes
large, upper with nearly
vertical range; teeth
with truncated tips ...
- †† Lateral line with high curve
above pectoral.....
- ** Supratemporal branch of
lateral line, if present, with-
out posterior prolongation.
- † Vertebrae 35 to 44, dorsal
less than 90, anal less than
70; intestine entirely con-
tained within body-cavity
of blind side.
- ‡ Lateral line with more or
less distinct curve above
pectoral; scales ad-
herent, when ctenoid
the spinules rather
short and generally not
numerous; eye-balls
not scaled.
- § Teeth obtusely conical,
lanceolate, or with
truncated tips, usu-
ally not much com-
pressed, never for-
ming a continuous
cutting-edge; at least
6 teeth on ocular side
13. PLEURONICETHYS.
14. ISOPSETTA.
15. PAROPHREYS.
16. LEPIDOPSETTA.

of each jaw; intestine of moderate length, not very narrow, usually with 2 or 3 coils; caudal with 11 or 12 branched rays

17. *LIMANDA.*

§§ Teeth incisor-like, compressed, sometimes forming a more or less continuous cutting-edge; less than 6 teeth on ocular side of each jaw; intestine elongate, narrow, with 3 or more coils; caudal with 13 or 14 branched rays

[PLEURONECTES.

18. *PSEUDO.*

‡‡ Lateral line rising a little above pectoral, but without distinct curve; scales thin, rather deciduous, those of ocular side ctenoid, the spinules slender and numerous; upper surfaces of eye-balls scaled; teeth obtusely conical

19. *DEXISTES.*

†† Vertebrae 48 to 65; dorsal 80 to 120, anal 65 to 102; second loop of intestine elongate, extending into secondary body-cavity of ocular side.

‡ Teeth almost entirely confined to blind side, never more than 3 on ocular side of each jaw; lips thick; 2 or 3 + 1 pyloric appendages; origin of dorsal not far behind posterior nostril of blind side; fin-rays stout

20. *MICROSTOMUS.*

‡‡ Teeth well developed on both sides, at least 7 on ocular side of each jaw; 2 to 4 + 2 to 5 pyloric appendages¹; origin of dorsal usually well behind posterior nostril of blind side.

§ Body ovate; skin thick, the median fins densely scaled; lips thick; gill-opening scarcely extending

¹ Not examined in *Embranchichthys*.

- above axil of pectoral; origin of dorsal nearly diameter of eye's length behind posterior nostril of blind side; fin-rays stout
21. *EMBASSICHTHYS.*
- §§ Body elongate-elliptical; skin rather thin, the median fins not very densely scaled; lips thin; gill-opening extending above axil of pectoral; origin of dorsal well behind posterior nostril of blind side; fin-rays not stout.
- || No mucous cavities on blind side of head; posterior rays of dorsal and anal branched
22. *TANAKIUS.*
- ||| Large mucous cavities on blind side of head; all dorsal and anal rays simple
23. *GLYPTOCEPHALUS.*
- β. Lower pharyngeals broader, 2 to $4\frac{1}{2}$ times as long as broad, massive, the inner edges more or less angular, usually approximated for at least $\frac{1}{2}$ their length, the teeth usually coarser and blunter, often molariform, in 2 or more series; 2 very short pyloric appendages.
- * Scales well developed, ctenoid in males, smoother in females; no bony tubercles; teeth incisor-like, forming a continuous cutting-edge; supratemporal branch of lateral line without posterior prolongation
24. *LIOPSETTA.*
- ** Scales well developed, all strongly ctenoid in both sexes, some of those on the head nearly tuberculate; teeth incisor-like, close-set; supratemporal branch of lateral line with short posterior prolongation
25. *INOSETTA.*
- *** Scales reduced, more or less embedded in the skin, all cycloid; head and body with bony tubercles or rugose plates; teeth ob-

- tusely conical or rather
incisor-like, not usually
forming a continuous cutting-
edge 26. PLATICTHYS.
- b. Postocular ridge broken up into
a series of 4 to 7 bony promi-
nences; lateral line with very
low curve above pectoral; scales
mostly cycloid and embedded
in the skin; no bony tubercles;
lower pharyngoals each with
2 rows of obtusely pointed or
molariform teeth; pyloric ap-
pendages short or of moderate
length, 2 or 3+1 27. PLEURONECTES.

2. Notes on certain Genera.

8. EOPSETTA.

Jordan & Coss, 1887, Rep. U.S. Fish. Com. xiii. (1885), p. 923
(*Hippoglossoides jordani* Lockington).

Xystrius Jordan & Starks, 1904, Bull. U.S. Fish. Com. xxii. (1902),
p. 623 (*Hippoglossus grigorjewi* Herzenstein).

Two species, one from the Pacific coast of North America, the other from Japan.

11. CLIDODERMA.

Bleeker, 1862, Verh. Akad. Wet. Amsterdam, xiii. p. 425 (*Platessa
asperrima* Temminck & Schlegel).

The exact position of this aberrant genus is rather doubtful, but it appears to be more nearly related to *Verasper* than to *Platichthys*, with which it has usually been associated. In many respects *Clidoderma* connects the large and symmetrical-mouthed *Pleuronectinæ* with those in which the mouth is smaller and the jaws and dentition markedly asymmetrical.

18. PSEUDOPLEURONECTES.

Bleeker, 1862, Verh. Akad. Wet. Amsterdam, xiii. p. 428 (*Pleuronectes
planus* Mitchill).

Limandella Jordan & Starks, 1906, Proc. U.S. Nat. Mus. xxxi. p. 204
(*Pleuronectes yokohamæ* Günther).

In addition to *Pseudopleuronectes americanus* from the Atlantic coast of North America, the two Japanese species of *Limandella*—*L. yokohamæ* and *L. herzensteini*—should be placed in this genus. They differ from the Atlantic species only in having the interorbital space narrower and ridge-like instead of flat, and the postocular ridge rugose.

19. DEXISTES.

Jordan & Starks, 1904, Bull. U.S. Fish. Com. xxii. (1902), p. 624 (*D. rikuzenius* Jordan & Starks).

Araias Jordan & Starks, 1904, *loc. cit.* p. 624 (*A. ariommus* Jordan & Starks).

Hubbs¹ has recently drawn attention to the general similarity of *Dexistes* and *Tanakius*, and it seems probable that these genera bear much the same relationship to each other as do *Pseudopleuronectes* and *Microstomus*.

23. GLYPTOCEPHALUS.

Gottsche, 1835, Arch. f. Naturg. i. (2), p. 136 (*Pleuronectes saricola* Faber).

Errex, Jordan, 1919, Proc. Acad. Nat. Sci. Philad. lxx. (1918), p. 343 (*Glyptocephalus zachirus* Lockington).

Apart from the elongated pectoral fin of the ocular side, *zachirus* is a typical *Glyptocephalus*. *Errex* is perhaps best to be regarded as a subgenus.

24. LIOPSETTA².

Gill, 1864, Proc. Acad. Nat. Sci. Philad. xvi. p. 217 (*Platesa glabra* Storer).

Euchalarodus Gill, 1864, *loc. cit.* pp. 216, 221 (*E. putnami*, Gill).

Gareus Hubbs, 1915, Proc. U.S. Nat. Mus. xlviii. p. 486 (*Pleuronectes obscurus* Herzenstein).

The four species of this genus (*obscura*, *glacialis*, *pinnifasciatus*, and *putnami*) form a natural group, connecting *Limanda* and *Pseudopleuronectes* on the one hand with *Platichthys* on the other. *L. obscura* (subgenus *Gareus*) is very similar to *Pseudopleuronectes*, the lower pharyngeals being narrower and less massive than in the other species of *Liopsetta*, the pharyngeal teeth being conical and arranged in two rows. It agrees with the remaining species of *Liopsetta*, however, in having the scales rougher in the males. Unfortunately, it has been impossible to ascertain the form of the pyloric appendages in this species.

25. INOPSETTA.

Jordan, 1887, Rep. U.S. Fish. Com. xiv. (1885), p. 924 (*Parophrys ichthyus* Jordan & Gilbert).

The relationship of this interesting genus appears to be with *Liopsetta* and *Platichthys*, although it has

¹ Annot. Zool. Japon. ix. 1918, p. 370; Occ. Papers Mus. Zool. Univ. Mich. cexlix. 1932, p. 1.

² Not to be confused with *Lyopsetta* Jordan & Goss.

usually been associated with *Parophrys*, *Isopsetta*, and *Lepidopsetta* on account of the short posterior prolongation of the supratemporal branch of the lateral line. It is possible that the single known species of *Inopsetta* from Puget Sound may eventually prove to be a hybrid between *Lepidopsetta* and *Platichthys*.

26. PLATICHTHYS.

Girard, 1856, Proc. Amer. Acad. Sci. Phil. vii. (1854), p. 139 (*P. rugosus* Girard).

Fleus Moreau, 1881, Hist. Nat. Poiss. Franco, iii. p. 298 (*Pleuronectes fleus* Linnaeus).

Kareius Jordan & Snyder, 1901, Proc. U.S. Nat. Mus. xxiii. p. 379 (*Pleuronectes scutifer* Steindachner).

Platichthys stellatus is very closely related to, perhaps even identical with, the European Flounder (*P. fleus*), and the two must certainly be placed in the same genus. *Kareius* may be retained as a subgenus for the Japanese species *P. bicoloratus*.

27. PLEURONECTES.

Linnaeus, 1758, Syst. Nat. ed. 10, p. 268; 1766, ed. 12, p. 455 (*P. platessa* Linnaeus).

Platessa Cuvier, 1817, R. Anim. ii. p. 220 (*Pleuronectes platessa* Linnaeus).

As now restricted, this genus contains only two closely related species: *P. pallasii* Steindachner (= *P. quadrifuberculatus* auct.), from the North Pacific, and *P. platessa* Linnaeus, the Plaice of Europe.

XXVII.—On *Tenuostrongylus cynictis*, gen. et sp. n., a *Trichostrongylid* parasitizing the Yellow Mongoose (*Cynictis penicillata*). By P. L. LEROUX, B.Sc., M.R.C.V.S., Central Research Station, Mazabuka, Northern Rhodesia.

THE specimens described in this communication were collected by the writer from a yellow mongoose, shot in the Bloemhof area, western Transvaal.

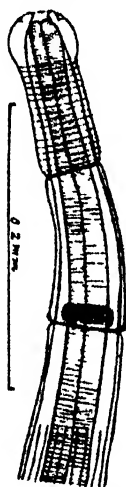
Although this species has certain characters in common with the species of *Trichostrongylidae* recovered from carnivores from South America, West Africa, and the Malay States, it could not be referred to any one of the genera *Molineus* Cameron (1923), *Microstrongylus* Cameron

(1927), and *Nematostrongylus* Cameron (1928), and the name *Tenuostrongylus cynictis*, gen. et sp. n., is designated for it.

Characters common to both Sexes.

The freshly collected specimens were flesh-coloured. This colour turned a dirty brown on their preservation in boiling glycerine-alcohol. The worms are comparatively long but slender, and have the cuticle on the cephalic extremity markedly inflated (fig. 1). This

Fig. 1.



Cephalic extremity.

inflation, which has a maximum diameter of approximately $50\ \mu$ in its anterior third, extends posteriorly for a distance of $98\ \mu$ and $108\ \mu$ in the males and females, respectively. Posteriorly the inflation is demarcated from the rest of the body by a groove formed by the non-inflation of the cuticle followed again by a very slightly inflated cuticle. This non-inflation of the cuticle surrounds the body completely and is identical with the cervical ring described by Cameron (1923, 1927, and 1928) for certain trichostrongylids from carnivores. The transverse striations are prominent on the inflated portion of the

cuticle, but do not encircle the body completely, as they terminate at the lateral lines.

The excretory pore opens into a groove which corresponds with the cervical groove described by Cameron (1927) for *Microstrongylus genettæ*. The cervical groove encircles the body completely and is situated at a distance of $188\ \mu$ and $217\ \mu$ from the cephalic extremity in the male and female, respectively. Anteriorly and posteriorly to this groove the cuticle is somewhat thickened.

The nerve-ring is situated just in front of the cervical groove and very minute cervical papillæ were observed immediately posterior to the groove. Cervical papillæ are also present in *Molineus felineus*, *Microstrongylus genettæ*, and *Nematostrongylus planicipitis*, and are situated just posterior to the level on which the excretory pore opens. They could only be detected under high magnification and in properly orientated specimens. It is doubtful whether these structures are absent in any species of *Trichostrongylidæ*.

At a distance of approximately $70\ \mu$ posterior to the cervical groove there appear longitudinal circular striations which extend posteriorly to the prebursal region in the male and to the anal region in the female. These striations are approximately $8\ \mu$ apart. On the more posterior parts of the body they number about sixteen, while half that number was met with in the more anterior regions. Under very high magnification their free edges appear beaded owing to the transverse striations crossing them.

The anterior extremity, which is attenuated, bears the oral aperture centrally placed and surrounded by the usual six circumoral papillæ met with in nematodes. These circumoral papillæ are rather minute, but their presence is readily proved by the indentations of the inflated cuticle. The buccal cavity is ill-developed and leads into an oesophagus which attains a length of $450\ \mu$ and $465\ \mu$ in the male and female respectively, while its maximum diameters in the corresponding specimens are $33\ \mu$ and $42\ \mu$.

Male Characters.

The male is 5.5 mm. long, and its body attains a maximum diameter of $81\ \mu$ in front of the copulatory bursa, which has its lateral wings folding in and over-

lapping ventrally. When opened out it is $144\ \mu$ long and $240\ \mu$ wide. Its ventral surface has the central portion studded with minute structures resembling spines. The distribution of the bursal rays is as figured (figs. 2 & 3).

Fig. 2.



Fig. 3.

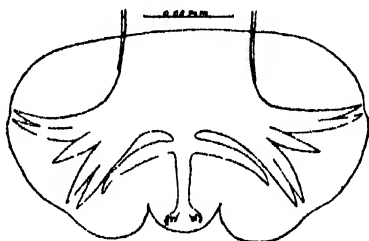


Fig 2 —Lateral view of bursa.

Fig 3 — Bursa spread open.

Prebursal papillæ are very minute and were only detected under high magnification and in properly orientated specimens.

Fig 4.



Fig 5.



Fig. 4.—Spicules.

Fig. 5.—Gubernaculum : A, lateral view ; B, ventral view.

The spicules (fig. 4), which are similar in build and length ($184\ \mu$), are well chitinised. The main body of each spicule terminates distally in a globular swelling,

while the spur, measuring approximately $90\ \mu$ in length, ends as an attenuated process.

The gubernaculum (fig. 5, A & B) is a relatively well-chitinated boat-shaped-like structure having a length of $90\ \mu$.

Fig 6



Fig 7.

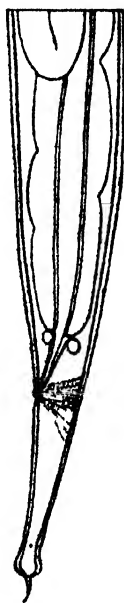


Fig. 6.—Female in region of vulva.

Fig. 7.—Posterior end of female.

Female Characters.

The female is 8.5 mm. long with a maximum diameter of $113\ \mu$ in the region of the vulva.

The vulva is situated at a distance of 1.84 mm. anterior to the anus and leads anteriorly into a short vagina which communicates with the ovejectors measuring

30 μ in length and having an average diameter of 45 μ . The anterior ovejector is very slightly shorter than the posterior one. Twelve eggs were observed in the anterior uterus, while the posterior one held ten. The measurements of these eggs varied from 50 $\mu \times 40 \mu$ to 60 $\mu \times 35 \mu$.

The anus is situated at a point 1.35 mm. in front of the posterior extremity, which has its cuticle slightly swollen, giving it a diameter of approximately 16 μ . The usual caudal papillæ are present, and the tail is furnished with a slender "spike" as recorded for the other *Trichostrongylidæ* of carnivores.

DISCUSSION.

Although the species under discussion is closely related to *Molineus felineus* Cameron (1923) from *Felis yaguarundi* from South America, *Microstrongylus genettæ* Cameron (1927) from *Genetta senegalensis* from West Africa, and *Nematostrongylus planicipitis* Cameron (1928) from *Felis planiceps* from the Malay States, it differs from them in certain characters which would seem to justify the creation of a new genus.

It differs from the members of the genus *Molineus* Cameron (1923) in that it possesses a cervical groove, a stout gubernaculum, and spicules of which the main body terminates distally in a globular point. It is readily distinguished from *Microstrongylus* Cameron (1927), which possesses rather slender spicules and a much differently shaped gubernaculum. It can likewise be separated from *Nematostrongylus* Cameron (1928) on the characters of its spicules and gubernaculum.

Furthermore, it may be observed that in *Nematostrongylus* the longitudinal striations start on a level with the excretory pore, while in *Microstrongylus* they originate on a level with the cervical ring, and in *Tenuostrongylus* they were observed to have their origin at a level well posterior to the cervical groove.

Whether the characters which differentiate the different genera are of real generic significance remains to be proved or disproved as more trichostrongylids are recovered from carnivores. At present the recognition of the different genera seems well founded.

The type-specimens of *Tenuostrongylus cynictis*, gen. et sp. n., will be deposited in the Helminthological collection

of the Imperial Bureau of Agricultural Parasitology,
Winches Farm, St. Albans, England.

ACKNOWLEDGMENTS.

The writer feels greatly indebted to Prof. R. T. Leiper and Dr. T. W. M. Cameron for lending for examination the cotypes of the species described by the latter. To Prof. J. H. Ashworth I am indebted for laboratory facilities enjoyed in the Department of Zoology, University of Edinburgh, during my visit to Edinburgh this year.

REFERENCES.

- CAMERON, T. W. M. 1923. "Studies on Two new Genera and some little-known Species of the Nematode Family Trichostrongylidae Leiper." Journ. Helm. vol. i. pp. 71-96.
 ———. 1927. "On *Microstrongylus genetice*, gen. et sp. n., a Trichostrongyle Parasite of *Genetta senegalensis*." Journ. Helmin. vol. v. pp. 81-88.
 ———. 1928. "On some Parasites of the Rusty Tiger-Cat (*Felis planiceps*)." Journ. Helm. vol. vi. pp. 87-98.

XXVIII.—*Notes on Myriapoda*.—XXXIV. *A rare English Centipede, Lithobius borealis Meinert*. By HILDA K. BRADE-BIRKS, M.Sc., M.B., Ch.B., L.R.C.P., M.R.C.S., D.P.H., and the Rev. S. GRAHAM BRADE-BIRKS, D.Sc., F.Z.S.

MEINERT (1868, p. 263) gives the following original description of *Lithobius borealis* :—

II. Lamina dorsalis nona angulis rostris, undecima, tredecima angulis productis.

(Pedes anales unguibus binis armati.)

6. L. BOREALIS.

Brunneus vel constans-brunneus, saepe fusco vittatus, laminis ventralibus pedibusque præter tarsos fusco-testaceis; sat robustus, capite subquadrato, paulo latiore quam longiore; subglaber.

Antennæ 28-33-articulatæ.

Oculi ocellis 9-11 (magnis), in series 3 digestis.

Coxæ pedum maxillarium secundi paris dentibus 4 armatæ.

Pori coxales 3, 3, 3, 2-3, 4, 4, 4.

Pedes primi paris calcaribus 0, 1, 1; pedes anales calcaribus 1, 3, 1, 0-1, 3, 3, 1 armati.

Long. 10-12 mm.

The following is from Latzel (1880, p. 90) :—

Vierte Artengruppe: *Hemilithobius* Stuxb., 1875.

Scuta dorsalia 11, 13 angulis posticis (manifeste) productis. (Vergl. pag. 35.)

Lithobius borealis Mein., 1808.

(Nat. Tidsskr. 5. Bd. p. 263.)

Brunneus vel castaneus, laminis ventralibus pedibusque pallidioribus; minus robustus, ante sublaevis, post obsolete rugosus, sparsissime hirsutus, capite subcordato, paulo latiore quam longiore. Antennae breviores vel sat longae, 32-33-articulatae. Oculi ocellis 6-8 in series 2-3 digestis. Corae pedum maxillar. dentibus 4 armatur.—Lamina dorsalis 11. et 13. angulis productis.—Pori corales 3, 3, 3, 2-3, 4, 4, 3, parvi vel minimi, rotundi. Pedes primi paris calcaribus 1, 1, 1-1, 2, 1.—Pedes anales unguibus binis, calcaribus 1, 3, 1, 0-1, 3, 2, 0 armati. Pedum analium articulus primus inermis.—Pedes postici breves, sat inflati. Genitalia femineor. unguis trilobus. Long. 10 mm. (Mein. 1872.)

When Bagnall published his check-list of British Myriapods (1918) he spoke thus of *Lithobius borealis* Meinert: "A Lancashire example is truly referable to this species; most, if not all other, records of *borealis* are referable to *lapidicola*." For the Ulster list Foster (1919) said of *Lithobius borealis*: "The inclusion of this species is somewhat doubtful, as in the past it appears to have been confounded with the next species" (*L. lapidicola*). Evans (1919), speaking of the Forth area, said: "the doubtful *Lithobius borealis* may possibly have been *L. lapidicola*."

As a matter of fact, for the British Isles we are certain only of one specimen of *Lithobius borealis*, the one to which Bagnall (*loc. cit.*) refers. As long ago as November 1918 this specimen was sent to us by Dr. R. S. Bagnall. The specimen was studied at the time and returned to him. The notes below are the result of our examination.

Lithobius borealis Meinert.

The following description is that of a male specimen with an identification label in Monsieur Henry W. Brolemann's handwriting. Dr. R. S. Bagnall collected the animal at Ainsdale, Lancashire.

This example is a fairly small spirit-specimen, dark brown, exhibiting very little difference in colour between the slightly lighter ventral surface and the darker dorsal plates. The body is slightly narrowed in front, more or less parallel-sided, with the anal legs long. The head is slightly broader than long, subcordiform in shape, and bears dark brown hairy antennae. The antennae are certainly shorter than half the body (the left antenna was damaged at its distal extremity, but 31 segments

remained, while the right antenna, which appeared to consist of 26 segments, was broken during examination). The eyes on each side consist of ten ocelli: one is large and posterior to the rest, and nine small ocelli are disposed in three rows, the arrangement of the whole being 1+4, 3, 2. The coxal elements of the maxillipedes are armed with 2+2 teeth, which are dark in colour and less elevated than in *Lithobius lapidicola* Meinert. These coxæ are separated from one another by a less acute re-entrant angle than seems usual in *L. lapidicola*. The eleventh and thirteenth dorsal plates are distinctly produced posteriorly into little angular projections and the posterior border of the ninth dorsal plate, which has no such projections, is slightly excavated towards the lateral extremities, tending to give the corners the effect of angular projections. The coxal pores are round and not strikingly small; on the left side their disposition on the twelfth to fifteenth legs appears to be 4.4.4.4, and on the right side 4.5.5.3. The anal legs have a double claw, the armatures being as follows:—

First pair	0.0.2.1.1	double claw.
	0.0.1.3.1	
Fourteenth pair	1.0.3.1.1	apparently double claw (damaged).
	0.1.3.3.1	
Fifteenth pair	1.0.3.1.0	double claw.
	0.1.3.3.0	

Length of body 12.5 mm., breadth at widest part (in the neighbourhood of the tenth body-segment) 1.6 mm.

It is to be hoped that the publication of this note may lead to the discovery of more specimens of this interesting animal.

Lithobius should be collected in 30–40 per cent. spirit, and should soon be transferred to 70 per cent. spirit for preservation. The material requires care in handling, because the legs easily fall off.

Since writing this brief account we find that Brolemann (1930, p. 290) referred to the specimen we here describe: "Nous avons vu un individu de Grande-Bretagne (BAGNALL leg.) que nous considérons comme appartenant à cette espèce"

REFERENCES.

- BAGNALL, R. S. 1918. "Records of some new British Diplopoda and Pauropoda, with a preliminary Check List of the British Myriapoda." *Journ. Zool. Research*, iii. pp. 87-93.
- BROLEMAN, H. W. 1930. 'Elements d'une Faune des Myriapodes de France, Chilopodes.' [Pau: Brolemann.]
- EVANS, WILLIAM. 1919. "On the Occurrence of *Glomeris perplexa* Latz, near Edinburgh; with a Revised List of Forth Myriapoda." 'The Scottish Naturalist,' May-June 1919, pp. 87-93.
- FOSTER, NEVIN H. Dec. 1919. "A List of the Myriapoda of Ulster." *Ann. & Mag. Nat. Hist.* (9) iv. pp. 395-407.
- LATZEL, ROBERT. 1880. 'Die Myriopoden der österreichisch-ungarischen Monarchie.' Erste Hälfte: Die Chilopoden. (Vienna: Holder.)
- MEINERT, FR. 1868. "Danmarks Scolopendrer og Lithobier." *Naturh. Tidsskrift af Skindto*, Kjøbenhavn, 3. Række, v. pp. 241-268.

Godmersham.

Canterbury, Kent,
16th June, 1932.

XXIX.—*Relationships and Habitat of Troödon and the Nodosaurus*. By C. M. STERNBERG.

(Published by permission of the Director of the Geological Survey of Canada, Department of Mines, Ottawa.)

Relationship of Troödon.

In several of his important papers dealing with the classification of Dinosaurs, Baron F. Nopcsa has placed *Troödon* with the Armored Dinosaurs (1, 2, 3). Gilmore has challenged (4, p. 31) the propriety of Nopcsa's latest assignment of this genus (3, p. 71), and shown, mainly from characters of the skeleton, that *Troödon* could not be included in the family Nodosauridae. Nopcsa replied by contending that Gilmore's "*Troödon* (5) is an artificial mixture built up of the skull of a heavily-armoured quadrupedal and the body of an unarmoured bipedal Dinosaur" (6). More recently Russell (7) has shown the improbability of Gilmore's material representing more than one individual, and has confirmed Gilmore's assignment.

Russell has answered Nopcsa's contentions very well, *Ann. & Mag. N. Hist.* Ser. 10. Vol. xi. 17

but there are a few points with reference to the osteology of the skull and teeth of *Troödon* and the Nodososaurs, which might be more fully stressed.

Nopcsa states that the skull of *Struthiosaurus* is built essentially on the lines of *Troödon*, but reference to his splendid figures of the specimen (3, Taf. i. figs. 1-4) shows no sign of a thickened parietal or frontal or a great backward extension of the occipital region which are so characteristic of the *Troödon* skull. The thick parieto-frontal mass seems unquestionably to be the result of a thickening of the cranial bones, and not the addition of dermal ossification as is the case with the Nodososaurs. In several specimens of *Troödon* which I have examined, the sutures between the frontals and between these bones and the parietals are distinctly shown from the brain-case to the surface, and in all specimens the sutures, between this dome-like mass and the other bones of the skull, show clearly throughout the thickness of the bone. Both Lambe (8) and Gilmore (4) have clearly illustrated this feature. In the Nodososaurs the sutures between the cranial bones are obscured, on the dorsal surface, by the dermal ossifications which cover them, but which do not coincide with them.

Another very important character is the presence of teeth in the premaxillæ. In even the more primitive members of the Stegosauroidæ the premaxillæ are edentulous. This character alone would seem to be sufficient to exclude *Troödon* from not only the Notosauridæ but the Stegosauroidæ.

Nopcsa states that the biology of the *Troödon* skull differs, as indicated by the structure of the teeth, essentially from that of all Ornithopoda. In 1925 I collected, from the Edmonton formation of Alberta, a nearly complete, articulated, skeleton of *Thescelosaurus* sp., in which part of the skull and the complete left mandibular ramus, with teeth, are preserved. This mandible compares very closely with Gilmore's figure of the mandible of *Troödon*, except that the anterior portion is longer and less steeply inclined. The teeth, on the other hand, more nearly resemble the mandibular teeth of *Edmontonia longiceps* (9), which is a typical Nodosaur, than do those of *Troödon*.

In Nopcea's characterization of the Ornithopoidea (I, p. 184) he gives "teeth with enamel reduced at one side," whereas for the Thyreophoroidea he gives "teeth with multicuspid margin and striated crown." An examination of the teeth of *Thescelosaurus* shows that the above tooth-characters cannot be used for subordinal determination, for while *Thescelosaurus* is undoubtedly an Ornithopod the teeth have multicuspid margins, striated crowns, and both faces are enamelled.

All of the above-mentioned facts seem to confirm Gilmore's assignment of the genus *Troödon* to a distinct family of the Ornithopoda.

Habitat of Troödon.

The above-noted similarities between the teeth of certain Ornithopods and Nodosaurus might suggest similar food-habits, though field-studies point to different habitats for *Troödon* and the Nodosaurus. In the collections of various museums there are approximately forty specimens of the parieto-frontal mass of *Troödon* which were collected from Alberta. In one case the skull is complete and part of the skeleton is preserved, and in two or three others some other bones of the skull are present. The rest show more or less wear, as if they had been rolled along by water. This leads to the theory that these animals lived on the high ground and only the more durable portion of the skull usually withstood transportation to the delta deposits in which they were preserved. The great abundance of this portion of the skull indicates that *Troödon* was one of the most common Dinosaurs of its day, and had they lived in the swamps, or on the deltas, surely articulated skeletons would be in similar proportion to those of the Hadrosaurs, Nodosaurus, Ornithomimids, and Ceratopsians.

Habitat of Scolosaurus.

In his splendid description and restoration of *Scolosaurus outleri* (2) Nopcea assigns a desert habitat to this species and presumably to other members of the Nodosauridae. His reasons for this assignment are largely the presence of a curled leaf and wind-blown sand in the abdominal cavity, and its resemblance to certain recent, desert

or semi-desert, reptiles. Eight years' field-work in the Belly River and Edmonton formations leads me to assign a lowland habitat to the Nodosaurus.

I visited the late W. E. Cutler when he was collecting the *Scolosaurus* skeleton, and am quite familiar with the beds from which it came.

The upper part of the Belly River series, from which *Scolosaurus culleri* was collected, seems to represent purely delta deposits. The rocks consist mainly of greyish argillaceous sands and sandstones alternating with thick beds of greyish and dark clay and thin beds of ironstone. There is a great deal of false or cross-bedding and beds of fresh and brackish water shells, and the bones of Pleiosaurs are not uncommon. At various horizons throughout these beds are to be seen "bone beds." These appear to represent the shore-line of a lake, beach, or river, where disarticulated bones, logs, etc., have been washed up to a given level. These are often at the junction of sand and clay beds. One of these "bone beds" is to be seen a few feet above the *Scolosaurus* "quarry," and nearby and a few feet below is a thick bed of Unios.

I have collected or observed seven, more or less complete, articulated, skeletons of Nodosaurus in these beds, and, with one exception, all were buried upside down. This would be very unusual if the animal died in the desert, but if it died in the water or was picked up by a flood just when the gases had expanded the abdominal cavity, the heavy plates on the back would naturally cause the carcass to float upside down. The skeleton would remain in this position until it lodged on a sand-bar or sank to the bottom of the lake after the gases had escaped. Disarticulated skulls of horned Dinosaurs, in which the brow horns are large, are almost invariably found upside down, whereas if the lower jaws are attached they are often lying on their side. This would indicate that the heavy horns caused the skull to turn upside down as it floated. On the other hand, articulated skeletons of Hadrosaurs, which are so numerous in these beds, are usually found lying on their side.

The presence of some wind-blown sand might well be explained by suggesting that the carcass lodged on

a sandbar during flood, but that later it was exposed to the sun and wind. While it is true that the recent spiny lizards, which Nopcsa mentioned, are desert or semi-desert dwellers, we also know that most of the broad-bodied short-limbed turtles inhabit swamps or streams.

REFERENCES.

- (1) NOPCSA, Baron F. 1928. 'Palaeobiologica,' i. Band (1928).
- (2) ——. 1928. 'Geologica Hungarica,' Ser. Pal. tomus i. fasc. 1 (1928).
- (3) ——. 1929. 'Geologica Hungarica,' Ser. Pal. fasc. 4 (1929).
- (4) GILMORE, C. W. 1930. Proc. U.S. Nat. Mus. vol. lxxvii. art. 16, pp. 1-39.
- (5) ——. 1924. Univ. of Alta., Dept. of Geol. Bull. no. 1.
- (6) NOPCSA, Baron F. 1931. Ann. & Mag. Nat. Hist. ser. 10, vol. viii. pp. 70-73 (July 1931).
- (7) RUSSELL, L. S. 1932. Ann. & Mag. Nat. Hist. ser. 10, vol. ix. pp. 334-7 (March 1932).
- (8) LAMBE, L. M. 1918. Trans. Roy. Soc. of Can. (3) vol. xii, sec. iv. pp. 23-26.
- (9) STERNBERG, C. M. 1928. Trans. Roy. Soc. of Can. (3) vol. xxii, sec. iv. pp. 93-106.

XXX.—*Report on a small Collection of Sponges from Stil Bay, S. Africa.* By MAURICE BURTON, M.Sc., Assistant-Keeper, Department of Zoology, British Museum (Natural History).

THE collection of sponges upon which the following report is based was made by Prof. T. A. Stephenson during the course of an ecological survey of Stil Bay, 200 miles along the coast eastwards from Cape Town. This collection, although small, affords a welcome addition to our knowledge of the South African sponges, and, as the section on distribution shows, indicates how important it is that the sponge-fauna of South Africa should be fully investigated.

SYSTEMATIC LIST OF SPECIES.

Order CALCAREA.

Leucosolenia coriacea (Montagu).

Distribution.—Practically cosmopolitan.

Leucosolenia cerebrum (Haeckel).

Distribution.—Europe (Mediterranean only).

Sycon ciliatum (Fabricius).

Distribution.—Europe.

Sycon gelatinosum (Blainville).

Distribution.—Australia ; Indo-Pacific.

Sycon munitum Jenkin.

Distribution.—Zanzibar.

Sycon kerguelensis Hentschel.

Distribution.—Kerguelen.

Heteropia glomerosa (Bowerbank).

Distribution.—Port Elizabeth, S. Africa ; Indian Ocean.

Order TETRAXONIDA.

Suborder HOMOSCLEROPHORA.

Oscarella lobularis (Schmidt).

Distribution.—Europe.

Suborder ASTROSCLEROPHORA.

Stelletta grubei Schmidt.

Distribution.—Europe.

Stelletta grubioides Burton.

Distribution.—Port Elizabeth, S. Africa.

Geodia littoralis Stephens.

Distribution.—Saldanha Bay, S. Africa.

Chondrosia reniformis Schmidt.

Distribution.—Europe ; Indian Ocean ; Australia.

Suborder SIGMATOSCLEROPHORA.

Tetilla cranium (Müller).

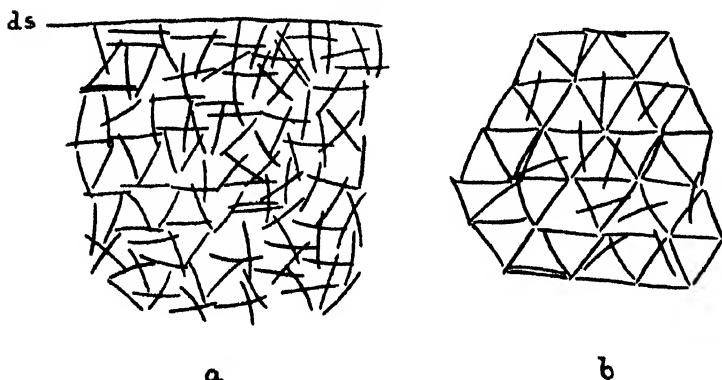
Distribution.—Europe; Arctic Ocean; N. coast of Canada.

Adocia simplicissima, sp. n.* (Fig. 1.)

Holotype.—B.M. 32.7.25.40.

Diagnosis.—Sponge thinly encrusting; surface smooth, even; oscules not apparent; texture soft, friable; main skeleton irregularly sub-isodictyal and mainly unispicular; dermal skeleton unispicular, with triangular mesh, often slightly irregular; oxea, usually, curved, $\cdot 12$ by $\cdot 004$ mm.

Fig. 1.



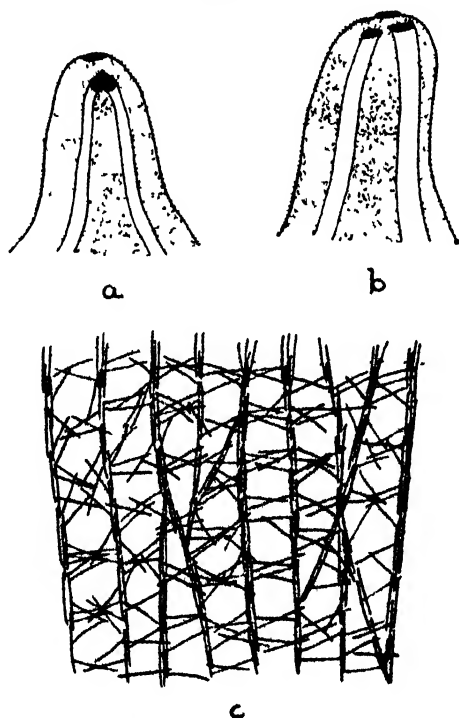
Adocia simplicissima, sp. n. a, section at right angles to surface (ds=dermal skeleton); b, dermal skeleton seen from above.

Remarks.—The distinctive feature of the species is its simple structure. It resembles *A. (Pellinella) conica* (Thiele) from S. America in the structure of its skeleton, but differs in external form and in the size of the spicules. Similarly, it differs from *A. (Pellina) integra* (Topsent) from Amboina in external form and size of spicules.

* The synonymy of the genus *Adocia* Gray will be dealt with in my report on the sponges of the Barrier Reef Expedition.

Haliclona cioalypsioides, sp. n. (Fig. 2.)*Holotype*.—B.M. 32.7.25.1.*Diagnosis*.—Sponge encrusting; surface even, porose, minutely hispid; oscules papillate, numerous, closely packed, seldom more than 3 to 4 mm. distant from each

Fig. 2.

*Haliclona cioalypsioides*, sp. n.

a, b, types of oscules, with subdermal canals shown leading up to terminal oscules; c, section at right angles to surface, showing structure of skeleton.

other; texture soft, compressible, friable; skeleton isodictyal, with ascending fibres bi- or trispicular, often branching and anastomosing, and joined by irregularly disposed single spicules (fig. 2 c); oxea usually curved, .115 by .003 mm.

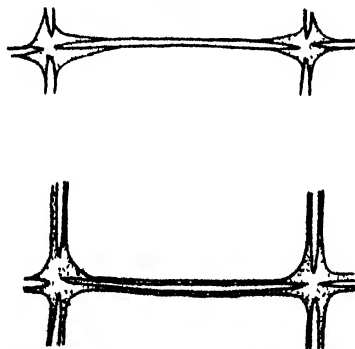
Remarks.—The characteristic feature of this species, which resembles *H. foraminosa* (Thiele, 1905, pl. xxvii. fig. 10) somewhat in appearance, is the structure of the oscules. These are usually solid papillate processes arising from the surface traversed by longitudinal subdermal canals, which end at their summits in one or more openings. The subdermal canals are roofed over by a thin dermis only, so that the papillæ appear to be longitudinally ribbed. Altogether the appearance of the papillæ recalls that of the fistulæ of *Ciocalypia*.

Haliclona stilensis, sp. n. (Fig. 3.)

Holotype.—B.M. 32.7.25.2.

Diagnosis.—Sponge encrusting to irregularly massive, with oscules papillate or level with surface; surface even, porose, minutely hispid; texture soft, compressible, somewhat friable; skeleton irregularly isodictyal, unispicular; spicules completely invested with spongin or joined only at nodes (fig. 3); oxea straight or curved, .12 to .15 by .003 to .007 mm.

Fig. 3.



Haliclona stilensis, sp. n., showing variation in distribution of spongin in fibres of skeleton.

Remarks.—In external form this species varies from that figured for *Isodictya cinerea* (Bowerbank, 1874, pl. xlviii. fig. 1) to that figured for *I. densa* (id. l. c. pl. 1. fig. 5). The characteristic feature is the unispicular network of the skeleton, the spicules of which are usually, but not invariably, completely invested in spongin.

Occasionally an ascending line of spicules may be bispicular or, rarely, trispicular.

Lissodendoryx sinensis Brøndsted.

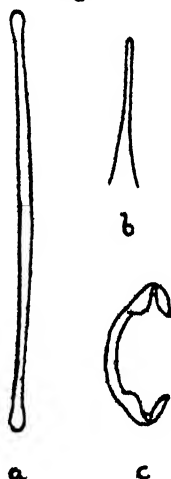
Distribution.—Indo-Pacific.

Forcepia agglutinans, sp. n. (Fig. 4.)

Holotype.—B.M. 32.7.25.39.

Diagnosis.—Sponge small, thinly encrusting, with numerous fragments of calcareous debris incorporated in its substance; main skeleton composed of wisps of tylota running to surface and ending in loose and irregular

Fig. 4.



Forcepia agglutinans, sp. n.

a, tylote, $\times 200$; b, forceps, $\times 200$; c, chela, $\times 650$.

brushes; tylota usually curved, $\cdot 28$ by $\cdot 006$ mm.; microscleres chelæ arcuatæ, $\cdot 028$ mm. chord, and forceps, of usual form, $\cdot 1$ mm. long.

Remarks.—This is an aberrant species of *Forcepia* characterised by the absence of acanthostyli, and with only one category of chelæ and forceps. It is probable, however, that the absence of the acanthostyli may be due to the fact that the holotype is merely an immediate post-fixation form, and that these would appear later.

In any case, the species is sufficiently close to the other species of *Forcepia* to be included in that genus.

Ciocalypa oculata var. *maxima* Hentschel.

This species may be identical with *C. polymastia* (Lendenfeld) (see Hallmann, 1914, p. 353).

Distribution.—Indo-Pacific.

Suberites stilensis, sp. n. (Fig. 5.)

Holotype.—B.M. 32.7.25.35.

Diagnosis.—Sponge regularly massive; surface even, harsh to touch; oscules not seen; texture compressible, soft; internal structure cavernous; colour ash-white; main skeleton of plumose fibres of tylostyli running to surface, branching and anastomosing, with, in places, numerous scattered spicules lying between fibres; dermal palisade of tylostyli similar to those of main skeleton, but smaller; tylostyli up to $\cdot 8$ by $\cdot 01$ mm.

Fig. 5.



Suberites stilensis, sp. n., showing various shapes found in heads of tylostyli.

Remarks.—The species resembles *S. capillitium* Topsent in external form and the shape of the spicules, and *C. laticeps* Topsent in the structure of the skeleton and shape of the spicules; but it differs from both in the much larger size of the spicules (up to $\cdot 8$ mm. long as against $\cdot 3$ mm. in Topsent's species). Nevertheless, there can be little question that the South African species and Topsent's two species, both from the Azores, are closely related.

Polymastia mammillaris (Müller).

Distribution.—N. Atlantic; N. Pacific; Arctic.

Tethya lyncurium Pallas.

Distribution.—N. Atlantic; West Indies.

Tethya diploderma Schmidt.

Distribution.—West Indies ; Indian Ocean ; Indo-Pacific ; Australia.

Order EUCERATOSA.

Aplysilla rosea Schulze.

Distribution.—Europe ; Australia.

Spongelia fragilis (Montagu).

Distribution.—N. Atlantic (including Azores) ; S. America ; Indian Ocean ; Australia.

Spongelia cinerea (Keller).

Distribution.—Red Sea ; Indian Ocean.

Hippospongia frondosa Hentschel.

Distribution.—Indo-Pacific.

Hircinia aruensis Hentschel.

Distribution.—Indo-Pacific.

GEOGRAPHICAL DISTRIBUTION.

The 28 species recorded from Stil Bay are distributed as follows :—

New species	5
Other points on S. African coast	3
Cosmopolitan	1
<hr/>	
Europe (including in some cases the Arctic and N. America)	7
Europe and Australia (and Indian Ocean in two cases). ..	3
<hr/>	
Australia and Indo-Pacific	2
Indo-Pacific	4
Indian Ocean	2
<hr/>	
Kerguelen	1

Excluding the S. African and cosmopolitan species, the new species, and the single one from Kerguelen, we have seven found elsewhere only in Europe, eight in the Indo-Australasian area, and three common to Europe and Indo-Australasia. This suggests that at Stil Bay,

more than at any other point on the S. African coast yet explored, there is a strong mixing of Indo-Australasian and European species. That this fact has great significance for the study of distribution is certain, but what this significance is cannot be fully determined until faunal groups have been revised for other parts of the world, especially for Australia and the Indo-Pacific.

The published works on the sponges of South Africa are few, and include those by Stephens (1915), Kirkpatrick (1902 (*bis*), 1903), and Burton (1926, 1929, 1931). In the report by Stephens, on sponges from Saldanha Bay, we find that 33 species are recorded (excluding *Reniera cinerea*, always a doubtful identification), which are distributed as follows :—

New species	15
Other points on S. African coast	6
Cosmopolitan	2
— — — — —	
Europe	8
Europe and Indo-Australasia	2

The species recorded by Kirkpatrick and Burton from the Natal coast are distributed as follows :—

New species	55
Other points on S. African coast	10
Cosmopolitan	nil
— — — — —	
Europe (including two from the Azores)	6
— — — — —	
Indo-Australasia	16

Comparing the three tables, we find that, if the local species be ignored, the European species far outnumber the Indo-Australasian species at Cape Town, that they are evenly divided at Stil Bay, but that Indo-Australasian species predominate along the Natal coast. This suggests that, at the very least, the South African coast is a key-position, and that an exhaustive study of its sponge-fauna must be made in order to understand fully the distribution of Atlantic and Indian Ocean species.

LIST OF LITERATURE REFERRED TO.

1874. BOWERBANK, J. S. 'A Monograph of the British Spongiadae,' vol. iii.
 1926. BURTON, M. "Descriptions of South African Sponges: Special Report.—IX." Fish. Mar. Biol. Survey, Cape Town, iv. 29 pp., 6 pls.

1929. BURTON, M. "Descriptions of South African Sponges: Special Report.—I." Fish. Mar. Biol. Survey Pretoria, vii, 12 pp., 2 pls.
1931. ——. "On a Collection of Marine Sponges mostly from the Natal Coast." Ann. Natal Mus. vi, pp. 337-358, 1 pl., 9 figs.
- 1902-3. KIRKPATRICK, R. "Descriptions of South African Sponges." Fish. Mar. Biol. Survey, Cape Town.—Part I.: 1902, pp. 219-232, 3 pls. Part II.: 1902, pp. 171-180, 1 pl. Part III.: 1903, pp. 233-264, 2 pls.
1915. STEPHENS, J. "Atlantic Sponges collected by the Scottish National Antarctic Expedition." Trans. R. Soc. Edinburgh, 1, pp. 423-467, 3 pls.

XXXI.—*A new Genus and Species of the Family*
Myrmeleonidæ. By D. E. KIMMINS.

[Plate VI.]

PSEUDIMARES, gen nov.

Costal cross-veins simple except immediately before the pterostigma. Apical area broad, with many veins and some cross-veins. Two feeble cross-veins in each anterior wing between *Sc* and *R* before the pterostigma in the ♂, absent in ♀. *Rs* in anterior wing arises midway between the base of the wing and the level of the fork of *Cu*₁. The branches of *Rs* do not form an "anterior Banksian line" in either wing, although there is a furrow in the membrane. *Cu*₂ and 1*A* separate. 1*A*, 2*A*, and 3*A* all present. Cross-veins between the branches emitted by *Cu*₂. Legs of the ♂ unusually long, posterior pair the longest, being about as long as the abdomen; lacking, owing to damage, in the only ♀ before me.

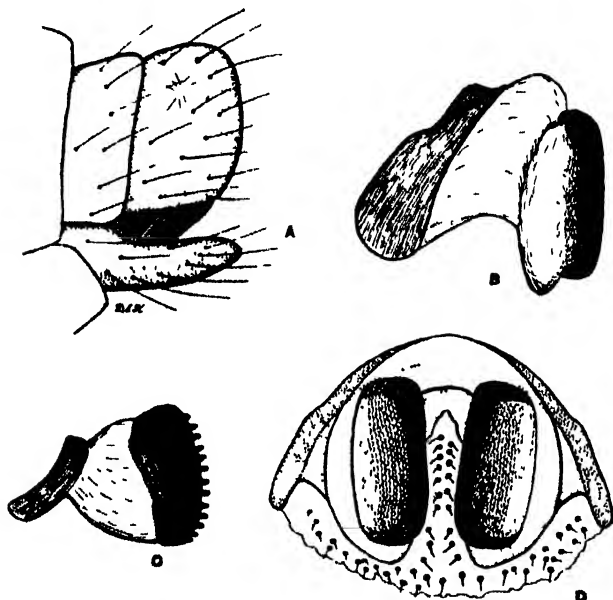
This handsome insect resembles in general venational plan examples of the American genus *Dimares* and also of the South African genus *Palparidius*. From the former it may be distinguished by its long legs, the presence of cross-veins between *Sc* and *R*, and the separation of *Cu*₂ and 1*A* in the anterior wings. From *Palparidius*, in addition to the first two characters mentioned above, it may be separated by the more strongly curved *Sc*+*R* in the apex of the wing, the position of the origin of *Rs* in the anterior wing, and the more rounded tips of the wings.

The structure of the ♂ genitalia appears to be more closely related to *Dimares* than to *Palparidius*.

The genotype is the following species:—

Pseudimares iris, sp. n.

♂.—Head tawny, occiput shining blue-black. Face very narrow. Eyes grey, large and globose. Antennæ pale, each with a brownish annulation at the base of the oval apical club.



Pseudimares iris, sp. n., ♂. A, anal appendages from side; B, internal genital structure from side; D, the same from behind; C, *Dimares subdulus* Walk., ♂, internal genital structure from side.

Prothorax greyish brown, elongate, its anterior margin produced and with a small excision in the centre. Towards the base of the prothorax there is a transverse raised ridge. Meso- and metathorax greyish brown. Legs pale, very long, clothed with black hairs and bristles; at the apex of each tibia a pair of slender, curved, reddish-brown spurs, as long as the basal tarsal joint. Tarsal claws long, slender, reddish brown.

Abdomen slender, brownish, terminating in a pair of subquadrate superior appendages (fig. A). Last ventral segment produced in the centre and in a lateral view forming a finger-like process. After treatment with caustic potash there can be seen within the superior appendages a chitinized structure (figs. B, D), consisting of an arch-shaped framework to the outer margin of which are hinged two strongly chitinized flaps. These flaps are elongate and convex, with their free inner margins directed towards each other. The surface of each flap is finely sculptured throughout. In *Dimares subdolosus* Walk. (of which a figure is given for comparison) these flaps are similar in shape, but their outer margins are strongly dentate. The arch-shaped framework in *D. subdolosus* is much smaller.

Wings shaped much as in *Dimares*, each in its apical third with a large eye-spot (about 6 mm. in diameter), the centre deep brown with violet reflections and surrounded by a shaded brownish ring. Apex of each wing tinged with brown and bearing a circular white mark over the pterostigma. In the apical area near the pterostigma the veins are a delicate rose-pink. A number of small spots towards the apex of each wing. Venation pale, marked with brownish as in the figure.

♀ (somewhat damaged, legs and antennæ missing).—Head with the eyes larger and more globose than in ♂. Colour of body more greyish. Abdomen with transverse bands of greyish yellow on a brown ground above, greyish yellow beneath. Wings larger, the brownish apices more evident, the iris of the eye spot in each wing a little larger in proportion than in the male, and the brownish surrounding ring deeper in tone and more sharply defined on its inner side.

Length of anterior wing, ♂ 43 mm., ♀ 53 mm.

Length of posterior wing, ♂ 41 mm., ♀ 51 mm.

Type ♂, S. Persia, Masjid-i-Sulaimaniah, Aug. 1929, taken at light (*Dr. Jamieson*). *Paratype* ♀, from the same locality, 7. ix. 32, found dead on verandah (*Dr. S. V. P. Pill*). Both specimens are in the British Museum.

EXPLANATION OF PLATE VI.

Pseudimares iris, sp. n., ♂. > 1½.

XXXII.—Three new Species of the Genus *Dericorys* Serv.
(Orthoptera, Acrididæ). By B. P. UVAROV.

THE types of the following new species are deposited in the British Museum (Natural History).

Dericorys philbyi, sp. n. (Figs. e & f.)

Similar in general appearance to *D. roseipennis*, Redt. Size under medium for the genus.

♂.—Antennæ as long as head and pronotum together, slightly incrassate apically.

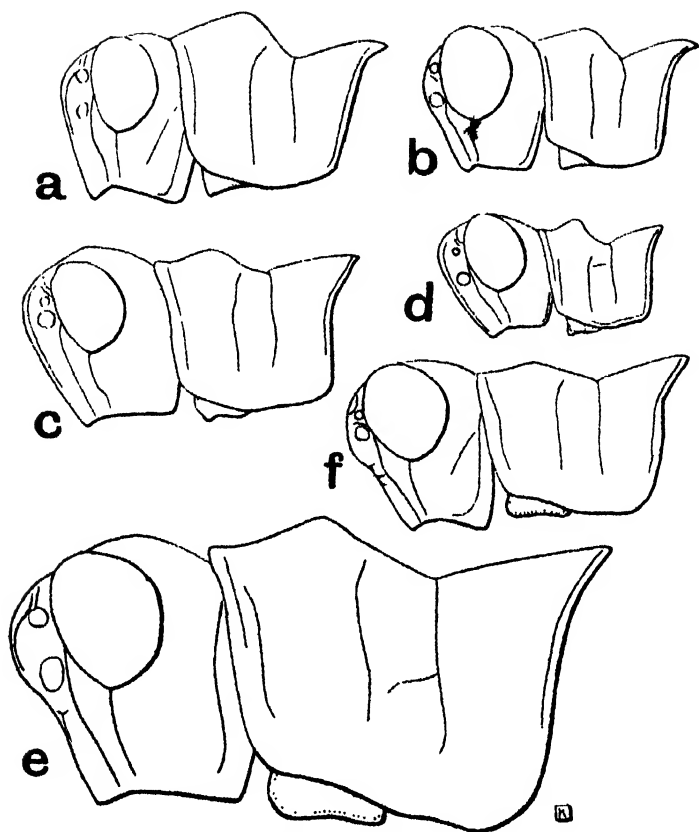
Face oblique. Frontal ridge in profile rounded, prominent between antennæ; viewed from the front it is slightly widened between antennæ, distinctly constricted under the ocellum, gradually widened towards the clypeus; its surface weakly convex above the base of antennæ, sulcate elsewhere. Fastigium of vertex strongly sloping forward, broader than frontal ridge between antennæ; its surface feebly concave, with a weak median carinula, low lateral margins, and a weak but distinct angular carinula separating it from the frontal ridge. Temporal foveolæ distinct, concave, open in front.

Pronotum relatively shorter and broader than in *D. roseipennis*. Prozona viewed from above appears broader than long; its front margin separated off by a deep and narrow but somewhat irregular submarginal furrow, and notched in the middle. Median keel thick, low, obtusely angulate in profile. First transverse furrow distinct not only on the lateral lobes but also on the disc, though it does not reach the median keel. Typical furrow deep, narrow. Metazona about three-quarters the length of prozona, strongly transverse; hind margin very obtusely angulate, almost rounded. Lateral lobes trapezoidal, longer than deep.

Prosternal tubercle short, conical, rounded on all sides. Mesosternal lobes longer than broad; the interspace strongly narrowed posteriorly, where it is about half as wide as in front.

Elytra extending beyond hind knees.

Hind tibia feebly curved, with about ten widely separated spines on each margin.



- a. *Dericorys johnstoni*, sp. n., ♀.
 b. *Dericorys johnstoni*, sp. n., ♂.
 c. *Dericorys ramachandrai*, sp. n., ♀.
 d. *Dericorys ramachandrai*, sp. n., ♂.
 e. *Dericorys philbyi*, sp. n., ♀.
 f. *Dericorys philbyi*, sp. n., ♂.

All figures to the same scale ($\times 5$).

General coloration very light ochraceous, with chalky white and greyish pattern, typical for the genus. Hind tibia of waxy colour; spines light red, black tipped. Wings pinkish, with the principal veins bluish.

♀ (*paratype*).—Larger; pronotum with the median keel more rounded and the hind margin of the prozona obtusely angulate.

Length of body, ♂ 24, ♀ 40; pronotum, ♂ 5, ♀ 7.5; elytra, ♂ 22, ♀ 38; hind femur, ♂ 13, ♀ 22 mm.

N.W. ARABIA: Al'ula, 29. vi. 1931, 1 ♂ (*type*), 4 ♀♀; Mulailih, 2. vii. 1931, 1 ♂ (*H. St. J. B. Philby*).

Easily separated from *D. roseipennis* by the shape of mesosternal interspace and the lobes, which in *D. roseipennis* are almost rectangular, with the interspace only slightly narrowed posteriorly. Hind tibiae in *D. roseipennis* are armed with about fifteen closely arranged spines on the outer margin and about ten larger and widely distant spines on the inner one, while in the new species there is little difference between the size and the arrangement of the spines on the two margins, their number being the same. Further differences exist in the structure of the vertex, which in *D. roseipennis* is more narrow, more deeply concave, and not separated from the frontal ridge; in the shorter prozona of pronotum in *D. philbyi*, with the median keel angular in profile; and in the colour of hind wings.

The new species is named after Mr. H. St. J. B. Philby, the well-known traveller and explorer of the innermost regions of Arabia.

Dericorys ramachandrai, sp. n. (Figs. c & d)

The smallest of all known species, and differing from them also in the strongly abbreviated elytra and wings of the female.

♂.—Antennæ a little longer than head and pronotum, not incrassate.

Face strongly oblique. Frontal ridge in profile strongly sloping, but not projecting between antennæ; viewed from the front it is distinctly widened between antennæ, constricted at the ocellum, and gradually widened towards the clypeus; the surface slightly concave even above antennæ and distinctly concave elsewhere,

the margins being very distinct throughout. Fastigium of vertex a little wider than the frontal ridge between antennæ, not closed in front, without the median carinula; the surface distinctly concave, with the margins well raised, acute. Temporal foveolæ indistinct.

Pronotum strongly saddle-shaped. Prozona less than half again as long as metazona; anterior submarginal furrow weak; first transverse furrow distinct only on the lateral lobes; median keel low, angular, with both sides of the angle distinctly concave in profile. Typical furrow weak. Metazona rounded behind. Lateral lobes trapezoidal, somewhat longer than deep.

Prosternal tubercle very short, obtusely conical. Mesosternal lobes slightly shorter than broad, with the inner angles obtusely rounded; their interspace broad, widened posteriorly.

Elytra just reaching hind knees.

Hind tibia curved gently, with about ten spines on each margin, those of the inner series being larger than the outer ones.

General coloration brownish, with whitish, grey, and chocolate-brown pattern. Elytra with a whitish pre-radial stripe. Wings colourless, with brownish veins. Hind tibia dirty bluish; inner spines yellow, the outer ones pale orange-yellow, all with the tips black.

♀ (*paratype*).—Fastigium of vertex scarcely longer than broad, with a faint median carinula and with a low carinula separating the fastigium from the frontal ridge. Median keel of pronotum bow-shaped in profile.

Elytra reaching a little beyond the middle of the abdomen, strongly narrowed apically.

Length of body, ♂ 14, ♀ 22; pronotum, ♂ 2.5, ♀ 5; elytra, ♂ 11, ♀ 13.5; hind femur, ♂ 7.5, ♀ 12.5 mm.

BRITISH BALUCHISTAN: Dasht, 14. viii. 1932, 1 ♂ (*type*), 1 ♀; Quetta, 12. viii. 1932, 1 ♂, 1 ♀; Mastung, 3. viii. 1932, 1 ♀ (*Y. R. Ramachandra Rao*).

A very remarkable species, easily recognizable by its small size, abbreviated elytra, and the structure of sternum. It is dedicated to Mr. Y. R. Ramachandra Rao, locust research entomologist, whose investigations on the Acridid fauna of Baluchistan are throwing much new light on that little known country.

Dericorys johnstoni, sp. n. (Figs. a & b.)

Size small for the genus.

♂.—Antennae about as long as head and pronotum together, incrassate in the apical portion.

Face moderately oblique. Frontal ridge in profile slightly prominent between antennae; viewed from the front it is rather broad and parallel-sided above the ocellum, constricted below it, and very feebly widened towards clypeus; the surface sulcate throughout, with the margins raised. Fastigium of vertex a little broader than frontal ridge between antennae, its lateral margins raised, but obsolescent anteriorly; surface weakly concave, not separated from the frontal ridge; median carinula scarcely perceptible. Temporal foveolae very small.

Pronotum distinctly saddle-shaped. Submarginal furrow distinct. First transverse furrow visible only on the lateral lobes. Median keel thick, its outline in profile represents an obtuse angle with both sides quite straight. Metazona roughly punctured, with a distinct raised median keel, obtusangular behind. Lateral lobes trapezoidal, a little longer than deep.

Prosternal tubercle conical, with the apex truncate and the anterior surface flat. Mesosternal lobes a little longer than broad, with the inner angles rounded; the interspace about as long as its width at the anterior margin, somewhat narrowed posteriorly.

Elytra extending well beyond the hind knees.

Hind tibia weakly curved, with ten or eleven spines on each margin.

General coloration brownish grey, with grey and whitish pattern. Elytra with an interrupted whitish pre-radial stripe. Wings faintly bluish, almost colourless, slightly infumate apically, with brownish veins. Hind tibia testaceous, with a blackish fascia; spines orange-red, black-tipped.

♀.—Face practically vertical. Pronotal keel rounded in profile.

Length of body, ♂ 17 (20), ♀ 25; pronotum, ♂ 3.5 (4.5), ♀ 5; elytra, ♂ 18 (19), ♀ 21; hind femur, ♂ 10 (12), ♀ 14 mm. (The second, larger, figures in the male measurements refer to a paratypic male.)

SUDAN: Khor Arbaat Delta, iv.-v. 1926, 2 ♂♂; Dongonab, Red Sea littoral, 5. ix. 1922, 1 ♂; Khor Akhuat near Port Sudan, 6. vii. 1925 1 ♀ (*H. B. Johnston*).

The shape of pronotal keel and the colour of hind wings make this species easily recognizable amongst others so far known.

The species is named after Mr. H. B. Johnston, locust research entomologist of the Imperial Institute of Entomology, who collected the specimens together with a number of other Orthoptera on the African coast of the Red Sea.

XXXIII.—*A new Gecko of the Genus Gymnodactylus from New Guinea.* By L. D. BRONGERSMA, 's Rijks Museum van Natuurlijke Historie, Leiden.

IN the collections of the Zoological Museum, Amsterdam, I found two specimens of a *Gymnodactylus* from Dutch New Guinea which I believe to be new to science. I propose to name it in honour of its collector, Professor Dr. P. N. van Kampen at Leiden, who has done so much to further our knowledge of Indo-Australian herpetology, not only through his many excellent publications on the Amphibia of that region, but also through his interesting collections from New Guinea.

Gymnodactylus vankampeni, sp. n.

Type, ♂, Northern New Guinea, from the surroundings of Modderlust (leg. P. N. van Kampen).

Paratype, ♀, same locality and collector.

These types were collected on the 17th and 18th of May, 1910; they are preserved in the Zoological Museum, Amsterdam.

Diagnosis.—A very small *Gymnodactylus* (♂, 29 mm.) related to *G. pelagicus* (Gir.), which it resembles in the absence of the lateral fold and in having regular rows of tubercles on the back. It differs from this species in the following characters:—Smaller size; no small chin-shields behind the symphysial; tubercles in 9 or 10 regular rows (in *G. pelagicus* this number is mostly larger); nostril bordered posteriorly by one shield (by 2 or 3 scales in *G. pelagicus*); male with a continuous series of 45 præanal and femoral pores (9 to 15 præanal pores in *G. pelagicus*).

Description.—Head rather large, flat. Snout as long as the distance between the orbit and the ear-opening,

once and a half the diameter of the orbit. Forehead not concave. Ear-opening round, one-third the diameter of the eye. Eye with vertical pupil. Head granular, the granules somewhat larger on the snout, but those next to the supranasals again smaller. No tubercles on occiput and temples. Rostral quadrangular, twice as broad as high, slightly curved backwards on the snout, with a median groove above. Nostril bordered by rostral, first upper labial, supranasal, and one post-nasal. The supranasals form a suture behind the rostral. Eight upper and seven lower labials. The symphysial is large, triangular or rounded posteriorly, longer than the lower labials. No chin-shields. Throat and belly with small ribbed granules. Back with small granules and nine or ten regular rows of slightly enlarged tubercles. No lateral fold. Tail round, tapering, covered with ribbed imbricate scales. The hind limb when pressed against the body reaches the axilla. Limbs covered with subequal granules; the scales of fingers and toes ribbed. Fourth toe with sixteen to eighteen infradigital lamellæ. The terminal lamella deeply emarginate and partly covered by the penultimate lamella.

Colour.—Dark brown, the markings on the back very indistinct. These consist of a double series of darker transverse spots or bands, at their posterior border lighter than the brown of the back; they resemble those of *G. pelagicus*.

Measurements (in mm.):—

	Type (♂).	Paratype (♀).
Head and body	29	27
Length of head ...	9	8
Width of head.	5	5
Height of head	3	3.5
Snout to fore limb....	12.5	12
Axilla to groin	13	12
Fore limb	10	8.5
Hind limb	12	13

Though the differences from *G. pelagicus* may seem to be slight, I believe them to be of sufficient value to separate these species. I have examined about forty specimens of *G. pelagicus* from various localities; all had small chin-shields behind the symphysial and a higher number of rows of tubercles on the back (12 to 21, the more usual numbers being 15 to 21).

MISCELLANEOUS.

The Nidification of the Birds of the Indian Empire.

To the Editors, Annals and Magazine of Natural History

SIRS.—In your January issue there is a very kind review of my book on 'The Nidification of the Birds of the Indian Empire.' May I be allowed to reply to one or two points raised therein?

First, as to the allocation of certain nests and eggs to definite geographical races of certain species. Your reviewer will find that in many places in my book I have shown that over certain areas it is quite impossible to say with certainty what race is to be found, and he will see that when I give descriptions of nests and eggs from these places—I very seldom do so—I state this quite plainly.

The birds to which he actually refers—*Leioptila* (not *Leioptila* as misprinted), *Fulveta*, and *Molpastes cafer*—do not come into the doubtful category, as all the eggs and nests described are from places where we know quite well which race is to be found. As regards *Troglodytes* the eggs described are, as is shown by me, accompanied by skins, mostly now in the British Museum, so that the doubt as to their identity does not exist. Whymper's birds and Osmaaston's birds taken with the eggs are in the Museum; about the Kashmir bird there can be no doubt as to what race it belongs to, and as regards the Tibetan Wren I have been very careful to say that my eggs are only *supposed* to belong to this bird.

What your reviewer says as to the correct identification of geographical races is so true and so important that it is perhaps advisable to stress the point that I have myself realized this.

As to the alleged misprints, the majority of those cited are in quotations from other writers which have been printed quite correctly according to the original spelling. "*Lankana*" for "*lantana*" seemed to me so definite a clerical error that I drew further attention to it by inverted commas, but as Davidson spelt it thus and in other places had referred to *lantana* I left it as written by him; it might possibly be a local name for something unknown to me.

Yours faithfully,

E. C. STUART BAKER.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 63. MARCH 1933.



XXXIV.—*The Relation between Somatic and Germ Cells in the asexually produced Polyps of the Polyzoon Alcyonidium gelatinosum.* By G. H. FAULKNER, D.Sc.

[Plates VII. & VIII.]

THE material for this work was collected during visits to the M.B.A. Laboratory in 1929 and 1931. I wish to thank Dr. E. J. Allen, F.R.S., for facilities for working in the Laboratory and the University of London for the use of their table.

Alcyonidium gelatinosum reproduces itself by both sexual and asexual methods. The colonies are originally founded by sexually produced larvæ, but their great and continuous increase in size is achieved by the repetition of an asexual process. Whenever colonies have been examined (this has always been between March and October) this asexual multiplication has been in active progress; but sexual individuals were found only on one visit which lasted from September 20th to October 14th, 1931. (The full extent of the sexual season is not known.)

Sexual generations are therefore separated by a series of asexual generations, and it is the purpose of this paper to trace the history of the germ-cells under such conditions, and to consider their relationship to and

their differentiation from the somatic cells. The female germ-cells only are dealt with here, as male individuals are comparatively rare, and material for studying the early stages of development of the testes has not been obtained.

Concerning the occurrence of gonads, individual polyps produce either male or female gonads, but a colony may at one time contain polyps of both sexes. The majority of the polyps even during the sexual season produced no gonads.

The histology of the formation of polyps is described under two headings:—

- I. The Development of the asexually produced Polyp.
- II. The Origin of the Female Germ-cells in the asexually produced Polyp.

I. DEVELOPMENT OF THE POLYP.

The course of development may be excellently examined in living polyps—in fact, this investigation originally arose from such observations. If a colony of *Alcyonidium* is teased up with sharp needles or very small knives, many complete and uninjured polyps become detached from their zoecia and may be transferred to slides and examined at leisure.

Figs. 1-8 (Pls. VII. & VIII.) are camera lucida drawings of such isolated and living polyps. They were all completed before any sectioned material was made, and hence show nothing more than was seen in life. They demonstrate the increase in complexity from a more or less spherical cell-mass to a fully differentiated polyp complete with mouth, anus, chambers of the alimentary canal, oecum, tentacles, tentacle-sheath, retractor muscles, and funiculus. The following detailed description is based upon the combination of these observations on living polyps with the results obtained from the examination of stained sections. For sections, colonies were most satisfactorily fixed with either Duboscq-Brasil or Allen's Bouin, and stained with Heidenhain's hæmatoxylin, with or without a counterstain.

New polyps are formed (as was previously known) from the epithelial lining of pre-existing zoecia. A par-

tition across the zoecium, formed by its wall together with the epithelial lining, cuts off a daughter zoecium in which a new polyp subsequently arises.

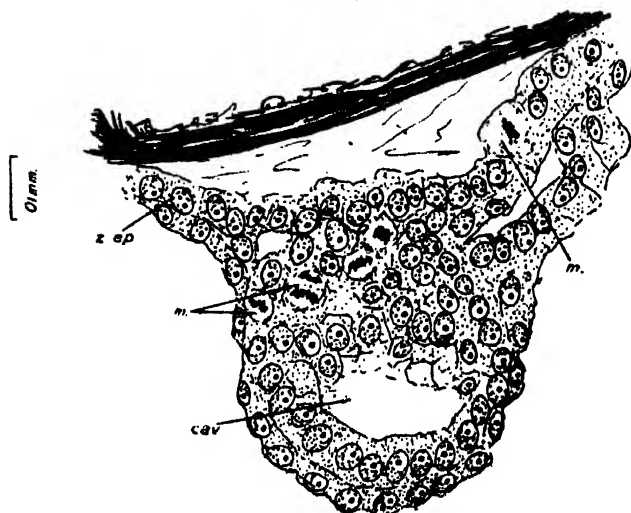
The above-mentioned epithelial lining of the wall is composed of two layers of cells, more or less distinguishable according to the age of the polyp and to the technique of fixation. A fragment of this double-layered epithelium pinched off from the parent zoecium is then the rudiment of a new individual.

The polyp is first seen as a proliferation of these epithelial cells against that face of the zoecium which forms the external wall of the colony. Both epithelial layers contribute to the outgrowth, hence a two-layered cup-shaped protrusion is formed hanging into the cavity of the zoecium (Pl. VII. fig. 1). As a result of further growth and the consequent enlargement of the concentric layers of epithelium, the polyp passes from a solid to a hollow phase (text-fig. 1).

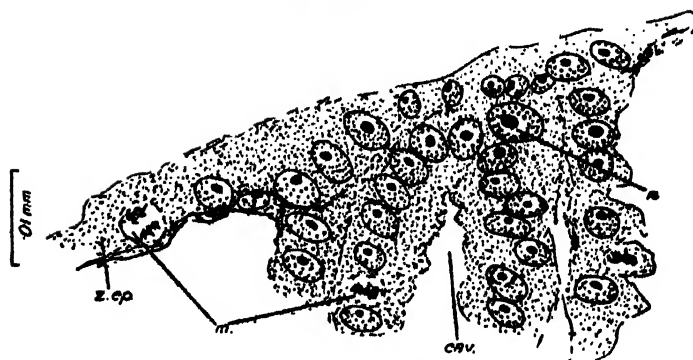
The cells in the polyp continue to divide, but kinesis are more abundant near the attachment of the polyp to the wall, where the epithelial layers of the wall and of the polyp are confluent (text-fig. 1). In this same zone of special activity, at approximately the time when the internal cavity becomes apparent, one or two isolated cells which are not incorporated in either epithelial layer are noticed (Pl. VII. fig. 2, and text-fig. 2). These cells differ conspicuously from the neighbouring polyp-cells by their large size, by nuclear characters, by staining reactions, and by their inter-epithelial situation. They appear to migrate between the two layers of the polyp-rudiment towards its distal pole (text-fig. 3). They divide (text-fig. 4), and the resulting daughter-cells all accumulate at one point, where they form a distinct cell-colony interpolated between the two cell-layers. The further multiplication of the cells causes the colony to protrude from the polyp as a mulberry-shaped mass hanging into the cavity of the zoecium and surrounded by the stretched epithelium of the outer layer (Pl. VII. fig. 3, and text-fig. 7).

There are now recognizable in the polyp three components which it is necessary to name and define. The innermost epithelium (derived from and continuous with the external epithelium of the zoecial wall) will

Text-fig. 1.



Text-fig. 2.

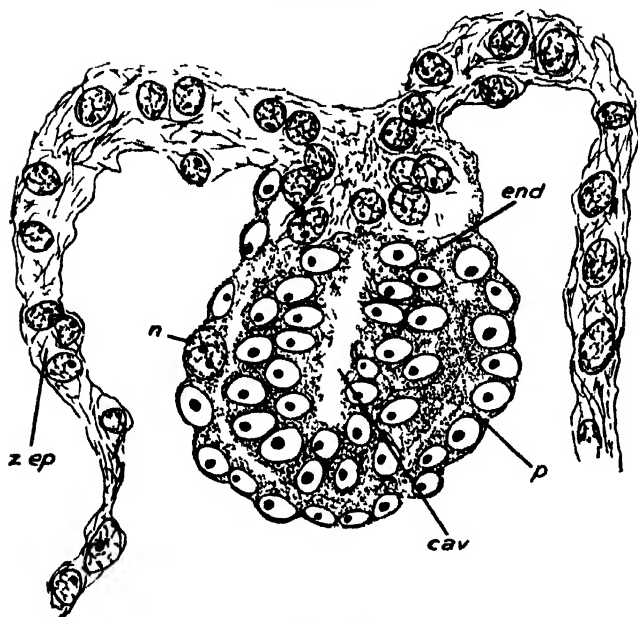


Asexual polyps as seen in sections.

Fig. 1.—Longitudinal section (not quite median) through the two-layered hollow cup-shaped polyp, showing mitoses in proximal half.

Fig. 2.—Polyp slightly older than in text-fig. 1; proximal half in longitudinal section, showing one neoblast lying between the two epithelia.

Text-fig. 3.



Text-fig. 4.

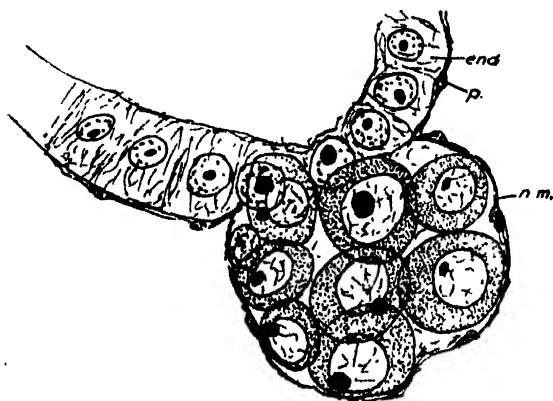


Asexual polyps as seen in sections.

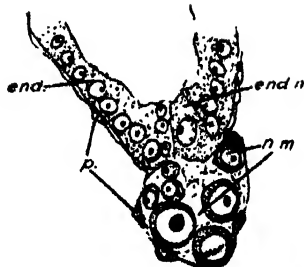
- Fig. 3.—Longitudinal section through young polyp, showing undifferentiated cells in region of attachment, and one of these (a neoblast) migrated into the polyp between the two epithelia.
- Fig. 4.—Longitudinal section through distal region of polyp of similar age to that of text-fig. 3; two neoblasts have reached the distal end of the polyp and are dividing.

be termed endoderm ; in its later developments a portion of it actually gives rise to the external epithelium of the tentacles, but nevertheless the more distal part, with which we are here concerned, gives rise to the various

Text-fig. 5.



Text-fig. 6.



Asexual polyps as seen in sections.

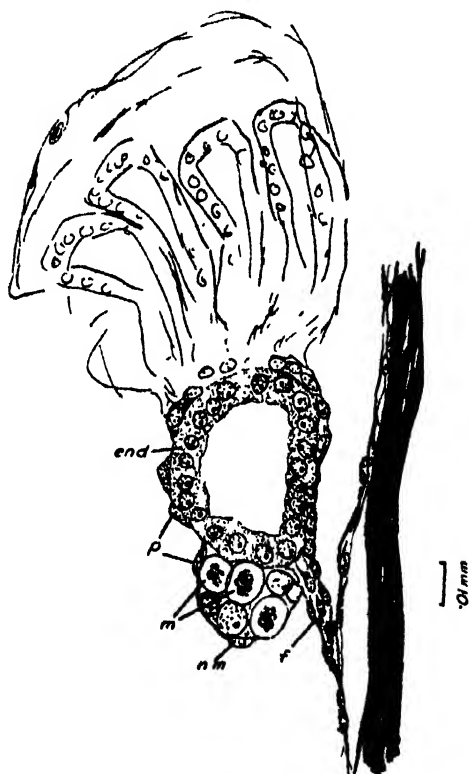
Fig. 5.—Neoblastic morula of polyp in the non-sexual season ; polyp similar in age to that in Pl. VIII. fig. 6.

Fig. 6.—Similar to text-fig. 5 ; showing one neoblast in the epithelial wall of the caecum ; also obtained in non-sexual season.

chambers of the gut, and hence the name endoderm is convenient. The outer membrane of the polyp (in continuity with the internal lining of the zoecial wall) will be called peritoneum ; and the intermediate and inter-epithelial cell-colony forming the projecting

lobe will be called the neoblastic morula. The term neoblast is taken from Annelidan morphology, and the reason and justification for using the word are given later, in the Discussion.

Text-fig. 7.



Asexual polyp as seen in section.

Longitudinal section of polyp approximately the same age as those in text-figs. 5 and 6, through caecum with neoblastic morula and funiculus; showing neoblasts dividing.

All the subsequent stages of development are best seen in the living polyps, and are chiefly concerned with the differentiation of the organs of the polyp (Pl. VII. fig. 4; Pl. VIII. fig. 8). The neoblastic morula

is conspicuous throughout, but during its development its position in relation to the parts of the polyp alters. In its final position (Pl. VIII. fig. 7) it is attached to the

Text-fig. 8.

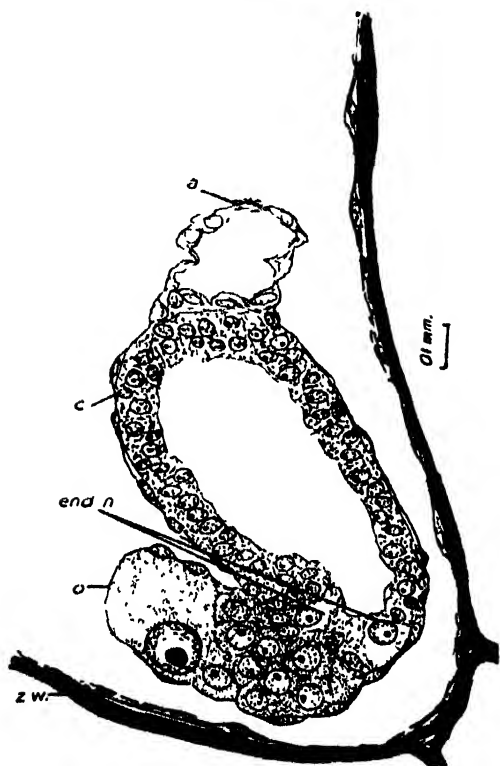


Development of ovary.

Longitudinal section through polyp with neoblastic morula becoming transformed into ovary; two mitoses are seen in ovary.

distal pole of the polyp adjacent to the attachment of the funiculus. At the point of its attachment a deep fold develops in the intestinal epithelium demarcating the cæcum, and for a time the neoblastic morula forms a bridge between the blind end of the cæcum and the

Text-fig. 9.



Development of ovary.

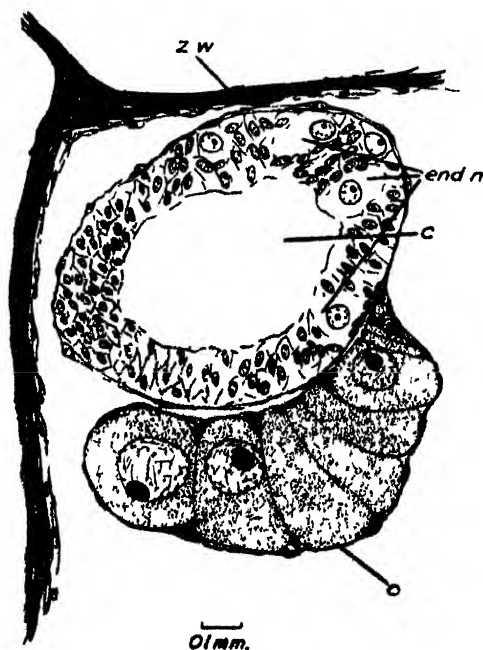
Longitudinal section through cæcum with young ovary attached.

adjacent wall of the intestine. Gradually the cæcum-wall separates from the intestinal wall, the bridge is stretched and ruptured, and the neoblasts remain as a cell-cluster attached to the oral side of the wall of the cæcum (Pl. VIII. figs. 7 & 8). This neoblastic cluster

gradually diminishes in size and finally vanishes entirely, leaving a smooth peritoneal covering over the cæcum.

Examination of sections of these stages adds details of cell-relationship to this general account, and two points of interest emerge. Firstly, very frequently the cells in the neoblastic morula are dividing (as in text-fig. 7), while the epithelial cells are not. Secondly,

Text-fig. 10.



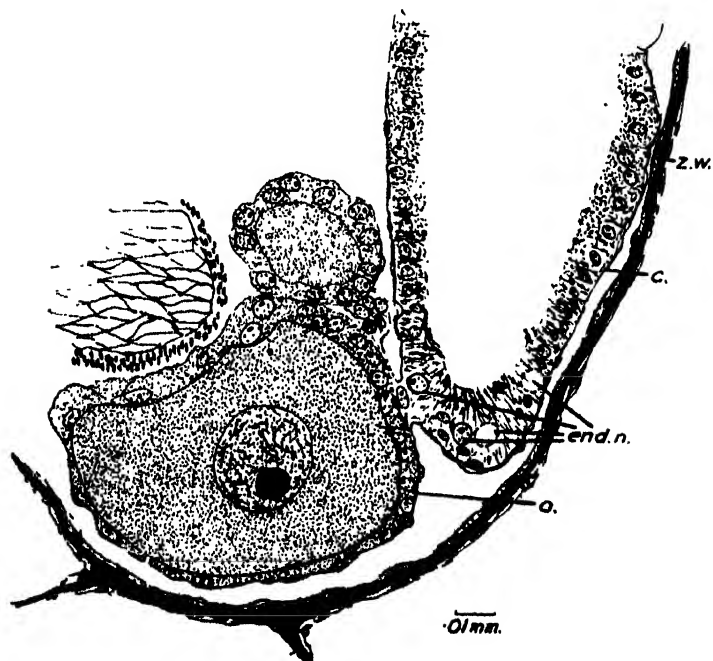
Development of ovary.

Transverse section through cæcum with ovary now linear.

the cells of the morula are not always sharply demarcated from those of the endoderm; some of them pass across the basement-membrane of the endoderm and take up a position among the endodermal cells as in text-fig. 5. Most of these cells become indistinguishable from endodermal cells, and so contribute to the formation of the epithelium. However, a few of the neoblast-cells con-

tributed last to the endoderm do not lose their identity, but retain a character of their own throughout the life of the polyp (text-figs. 6, 8, 9, 10, & 11). Such cells were also noticed in the living polyps shown in Pl. VIII. figs. 7 & 8, although their significance was not then recognized. Any number between two and six of such cells may occur; they are present in sexual and asexual

Text-fig. 11.



Development of ovary.

Section through caecum and proximal ovum of fully developed ovary; the intestinal epithelium is beginning to degenerate.

polyps equally, and they are still conspicuous even at the time when the interstitial cells are breaking down at the commencement of the "brown body" phase. Their presence in the epithelium has been described by Silbermann (1906), who, however, gave no satisfactory explanation of them.

When the neoblastic morula has vanished, divisions of the cells of the polyp, which have previously been rare, are found more abundantly.

II. ORIGIN OF THE FEMALE GERM-CELLS IN THE ASEXUALLY PRODUCED POLYP.

A polyp which will enter a sexual phase is not distinguishable from non-sexual individuals until somatic differentiation is complete. At this stage in the non-sexual individual the neoblastic morula diminishes and finally vanishes, but in the female polyp, on the contrary, it persists, increases in size, and simply takes upon itself the characters of an ovary.

The first sign of the transition from a non-differentiated neoblastic morula to a sex-gland is a change in the arrangement of the component cells. In the morula the cells are massed in an (apparently) irregular fashion; and the first indication of their development into an ovary is the alignment of the cells in a linear series; subsequently a hanging tongue more or less curved round the polyp is formed composed of a single row of ova (text-fig. 10).

The morphological relationship of the ovary to the polyp remains exactly the same as that of the morula to the polyp, *i. e.*, the ovarian cells lie between the endodermal cells and the peritoneum, and are always covered by a sheet of peritoneum continuous with that covering the gut (text-figs. 8, 9, & 10); moreover, the ovary is attached to the oral face of the cæcum adjacent to the attachment of the funiculus, and at the point of attachment there is always at least one endodermal neoblast located (text-figs. 8, 9, 10, & 11).

Multiplication of the oocytes takes place in the proximal cells of the young ovary (text-fig. 8), *i. e.*, in the cells against the basement-membrane of the endoderm. Hence the more distally situated ova are the oldest and largest. Later each oocyte is surrounded by a single layer of follicle-cells, whose origin is not discussed here.

DISCUSSION.

Among the many papers hitherto written on Polyzoa I have found none which is relevant to the particular

subject under consideration here. Romer (1906) describes the growth of polyps in the allied species *A. mytili*, but mentions nothing resembling the neoblastic morula of *A. gelatinosum*; no further citation need be made of all the literature which has been consulted.

The discussion centres round the particular cells which have been called neoblasts, their behaviour and significance, and the use of the word "neoblasts" for them.

These cells are first recognized in the region of attachment, which is also the region of proliferation, of the two-layered hollow polyp, and later migrate into the polyp between the two layers of the epithelium to the distal pole. Here they accumulate and proliferate, and give rise to what has been called the "neoblastic morula."

In the early stages, as in text-fig. 3, the neoblasts are sharply demarcated from the other cells of the polyp, not only by their isolated or inter-epithelial position, but also by their appearance. The section drawn in text-fig. 3 was stained with hæmatoxylin and eosin, and all the cells of the polyp except the neoblasts have a pink colour, whereas the neoblasts have no trace of pink; they are, in fact, distinguishable in appearance from the cells at the point of attachment of the polyp and those of the adjacent body-wall. It is suggested that they are isolated cells produced from the epithelium of the wall in the same way that the whole rudiment of the polyp is produced, but that, instead of becoming differentiated at once into somatic cells, they retain their undifferentiated character along with a capacity for continuous proliferation.

The cells produced by their activity may remain similarly unspecialized for some time; but some of them contribute to the formation of the intestinal epithelium, while others, towards the end of the period of differentiation of the organs of the polyp, migrate into the intestinal epithelium and remain there throughout the life of the polyp without losing their identity. The significance of these cells is not as yet apparent to me.

During the sexual season, the neoblastic morula which has been contributing to the cells of the soma of the young polyp, and which would in a non-sexual

polyp gradually vanish, now continues its active proliferation, and the cells resulting from this later multiplication become the female sex-cells.

It is now necessary to justify the use of the term "neoblasts" for these cells. The original use of the word has been discussed by Korschelt (1927, p. 299), and it has since then been used repeatedly in Oligochaete morphology (cf. Stephenson, 1930, pp. 569 *seq.*); the only uses in Polychaete morphology known to me are in Malaquin (1925) and Faulkner (1930, 1932).

The essential characters of neoblasts in Annelids seem to be (i.) that they are undifferentiated cells which are separated from the somatic cells at a more or less early stage of development; (ii.) that they retain a capacity for active proliferation, and may be stimulated to such activity for the purpose of assisting normal growth of the body, for growth associated with asexual reproduction, for regenerative growth, and for the production of sex-cells; (iii.) that they are independent of the so-called germ-layers and retain permanently an inter-epithelial situation.

Since the above-described cells in *Alcyonidium* agree in all these essential characters with the neoblasts of Annelids, it is thought desirable to use the same term for them, in order to indicate and emphasize the similarity of the processes of growth in both phyla.

SUMMARY.

In the development of the asexually produced polyp of *Alcyonidium gelatinosum*, certain cells (the neoblasts) are set aside and remain undifferentiated. They proliferate and contribute to the growth of the alimentary canal, and in female sexual individuals give rise also to the female sex-cells. They are always inter epithelial in position, lying between the basement membrane of the endoderm and the peritoneum.

BIBLIOGRAPHY.

- FAULKNER, G. H. 1930. "The Anatomy and the Histology of Bud-formation in the Serpulid *Filograna implexa*." *J. Linn. Soc., Zool.* xxxvii.
 ———. 1932. "The Histology of Posterior Regeneration in the Polychaete *Chaetopterus varicopedatus*." *J. Morph.* liii.
 KORSCHULT, E. 1927. 'Regeneration und Transplantation,' Bd. 1.

- MALAGUIN, A. 1925. "Les cellules germinales (gonocytes) sont, au cours de la reproduction asexuée de *Salmacina dysteri*, le source de la prolifération blastogénique." C. R. Acad. Sci. Paris, T. clxxx.
- ROMER, O. 1906. "Untersuchungen über die Knospung, Degeneration und Regeneration von einigen marinen ektoprokten Bryozoon." Z. wiss. Zool. lxxxiv.
- SILBERMANN, S. 1906. "Untersuchungen über den feineren Bau von *Alcyonidium mytili*." Arch. Naturgesch. lxxii, Bd. 1.
- STEPHENSON, J. 1930. 'The Oligochaeta.' Oxford.

EXPLANATION OF THE PLATES.

(All figures, in plates and text, were drawn with the aid of a camera lucida.)

PLATE VII.

Figs. 1-8. Asexual polyps as seen in life. (Obtained in the non-sexual season.)

- Fig. 1. Early stage; solid outgrowth from wall of zoecium with torn attachment.
- Fig. 2. Slightly later stage with one large cell (neoblast) conspicuous in the interior, near the region of attachment.
- Fig. 3. Two-layered hollow sphere with the neoblastic morula attached.
- Fig. 4. Polyp with tentacles forming.

PLATE VIII.

- Fig. 5. Polyp with gut more fully differentiated.
- Fig. 6. Later stage with the caecum demarcated and morula attached to both caecum and intestinal wall. (Position of polyp is reversed as compared with the other figures, anus to the right.)
- Fig. 7. Fully differentiated polyp with neoblastic morula diminishing; intestine pigmented.
- Fig. 8. Caecum and adjacent parts of alimentary canal only, showing remnant of neoblastic morula on oral aspect of wall of caecum.

Explanation of lettering in figures (plates and text-figures).

a., anus; c., caecum; cav., cavity of polyp; end., endoderm; end.n., endodermal neoblast; f., funiculus; m., mitosis; n., neoblast; n.m., neoblastic morula; o., ovary; p., peritoneum; z.ep., zoecial lining epithelium; z.w., zoecial wall.

XXXV.—On the Taxonomic Value of the Subgenus *Lophomops* (*Nyctinomina* Bats), with Remarks on the Breeding Times of African Bats. By F. WIMPFEN BRÆSTRUP, Copenhagen.

Lophomops was established as a subgenus of *Chærophon* by J. A. Allen in 1917 (Am. Mus. Congo Exp. Coll. of Bats, Bull. Am. Mus. Nat. Hist. xxxvii. p. 460) to include some African members of that genus having a heavy crest of long straight hairs arising from the

back of the membrane connecting the ears, this being a sexual character observed in males only. He quotes de Winton's statement (Ann. & Mag. Nat. Hist. (7) vii. p. 39, 1901) that there is in *Chærephon limbatus* a long crest of erect hairs behind the connecting membrane of the ears in the males, suggesting that the specimens described by de Winton were not the true *C. limbatus* of Peters, and are perhaps referable to some form of *Lophomops* because "Peters does not describe nor do his figures represent such a crest as is seen in *Lophomops*." Allen refers three new species to this group, two with a bicoloured crest and one with a shorter unicoloured brown tuft. Since then two additional species of *Lophomops* have been described.

Chærephon (Lophomops) shortridgei Thomas (P. Z. S. 1926, i. p. 289), from N.W. Ovampoland (7 Oct.), has a bicoloured tuft 13 mm. in length as in Allen's *C. chapini*. Thomas expressed "considerable doubt as to the taxonomic value of this specialization, striking as it is, for the species described by Dr. Allen as *Chærephon cristatus* and *abæ* have it far less marked, while *Chærephon hindei* also has the connecting membrane of the ear tufted behind, the character chiefly relied on by Dr. Allen in forming the subgenus *Lophomops*. The reduction to two of the lower incisors, usual in *Lophomops* according to the describer, does not occur in *Chærephon hindei*, which has four, as in other members of *Chærephon*." He thinks it possible "that the character of the aural tuft will merely prove another specific specialization in the plastic genus *Chærephon*."

In *Chærephon (Lophomops) nigri* R. T. Hatt (Bull. Soc. Zool. de France, liii. p. 374, 1928) from Bourem, Soudan Français, collected 6th January, there is in the type a tuft 5 mm. in length, but in a male paratype of the same date there is none. This species seems from the short description quite similar to *Chærephon pumilus*, in the same way as *Chærephon (Lophomops) cristatus* seems from Allen's description and measurements, apart from the crest, to resemble his *Chærephon frater* from a nearby locality, which is probably also a member of the "Rassenkreis" *Chærephon pumilus*. Hatt compares his species with *Chærephon (Lophomops) cristatus* only, and, curiously enough, neither he nor any of the authors

quoted above seems to have noticed that Dobson in his paper on "the group *Molossi*" (P. Z. S. 1876, p. 723), and with the same words in his 'Catalogue,' clearly describes the tuft in *Chærephon pumilus* from a Gambian male (apparently lost). In spite of this de Winton in his description of *C. gambianus*, which he considers the form described by Dobson as *C. pumilus*, mentions as a feature distinguishing it from *C. limbatus* that there is no crest in the males!

Thus from the literature it appears that there is "something rotten" in the crest as a distinctive feature in *Chærephon*.

In working out a collection obtained during the Danish Expedition to French Sudan and Nigeria 1927-28 (the report of which will appear shortly) the find of some crested males of *Chærephon* induced me to take up this question, and during a visit to the British Museum I was kindly permitted to make some notes which may be of interest, as they seem to show conclusively that the said crest is seasonal, assumed during pairing time and lacking at other times of the year.

The following table shows the occurrence of the crest in the examined males of the race-circle (species in a wide sense) *Chærephon pumilus*. The approximate length of the tuft is stated in each case; 0 means that there is no tuft. The specimens are preserved in spirit in the British Museum, with the exception of the last six specimens from the Copenhagen Museum:—

Species.	Number of specimens.	Locality.	Date.	Length of tuft. mm.
<i>C. p. hindei</i>	5	Fort Hall.	No date.	4.5, 5, 6, 6.4, 8.3.
	1	Entebbe, Uganda.	Jan. 29.	0.
<i>C. p. limbatus</i> . . .	5	Entebbe, Uganda.	No date.	0, 0, 0, 0, 0.
	2	Cesee Isl., Victoria Nyanza.	May.	0, 0.
<i>C. p. pumilus</i> . . .	1	Abyssinia.	No date.	5.5.
	4	Harar.	No date.	6, 7.5, 7.5, 8.5.
	1	Lagos.	No date.	0.
<i>C. p. websteri</i> . . .	1	Ibi, S. Nigeria.	No date.	6.
	1	Benin, Niger Delta.	No date.	0.
	3	Mopti.	May 20.	6, 6, 6.
<i>C. p. pumilus</i> . . .	1	Mopti.	May 21.	0.
	1	Mopti.	May 24.	6.
	1	Niamay.	Oct. 8.	6.

It was found by examination of these specimens that a marked correlation is present between the

development of the testes and the presence of the aforesaid tufts, the scrotal sac being shrunk in the specimens without a tuft and swollen in the individuals possessing it.

It is, of course, impossible to observe the condition of the genital organs from skins, nor are there any records on the labels, but it is possible from the dates to get some information as to whether the tufts are found at fixed seasons, and thus we may indirectly learn something about the pairing time of these bats.

In the following list the skins of males of *Chærephon pumilus* in the British Museum are arranged by dates. The length of the crest is given in mm., as in the previous list 0 = no crest:—

Date.	Number of specimens.	Locality.	Length of tuft. mm.
Jan. 1	1	Fort Hall.	6.1.
Jan. 4	1	Fort Hall.	8.1.
Jan. 23	2	Galab, Sudan-Abyssinian Boundary.	2, 4.
Feb. 4	1	Cunga, Angola.	6.5.
April 6	4	Upper Nile.	3.3, the others very short.
April 17	1	Mongalla.	2.5.
May 10	1	Rio Shire, Nyassa.	2.3.
May 23	1	Taveta, Kilimanjaro.	0.
May 27	1	Fort Hall.	6.2.
May 30	6	Mombassa.	6.5, 6.5, 0, 0, 0, 0.
June 4	1	Malakal, White Nile.	5.5.
June 7	1	Kirimo, Nyassaland.	5.5.
June 29	1	Casuala, N. Angola.	6.5.
Aug. 7	1	Dancila, S. of L. Tana.	0.
Aug. 23	1	Tete, Zambesi.	8.

With these may be compared the few dates of the list of spirit-specimens above, to which may be added the dates given by Allen: the type and three topotypes of *Chærephon (Lophomops) cristatus* (probably a synonym of *Chærephon frater*, i. e., *Chærephon pumilus frater* described first) were collected on January 25 and 29 and June 15, the type and topotype of *Chærephon (Lophomops) chapini* are from November 11 and January 12, and *Chærephon (Lophomops) abæ* (which may belong to the same race-circle as *major* and *emini*) was collected December 17.

From this nothing very definite may be deduced, but it seems probable that the crest is assumed twice a year. In the more northern regions it appears to be

present from October to January, to appear again in April, from which time several specimens from the Sudan present a new growth of tufts. The absence of the tuft in four of the six specimens from Mombassa, May 30, may indicate that the animals in that locality are losing it thus early. The single specimen from Abyssinia collected in August has no tuft, and the males of *Chærephon frater* Allen (without tufts) seem to be collected in July, though it is not expressly stated.

The records of the breeding-time of African bats are very meagre. From the field-notes by Lang and Chapin (Bull. Amer. Mus. Nat. Hist. xxxvii. p. 497, 1917), however, some information may be gathered.

Among Molossidæ foetuses were found in April (*Nyctinomus ochraceus*; out of 18 females collected on April 16 at Medje 12 had a large embryo) and in August–September (*Mops congicus*, September 8, Medje, 5 out of 12 females had a large embryo, 1 *Mops trevori* female collected on September 29 had a very large embryo, and out of 20 *Chærephon russatus* examined on September 6 each had one foetus). Two yearly breeding periods in these months seem, indeed, from Lang and Chapin's notes, to be normal to the Microchiroptera of the Congo Basin, as the embryos are all found in January–March and August–September (with the exception of *Saccolaimus pelii*, where embryos were found in June and December)—this is also the case in those species of which the authors state that they breed "at different periods." The find at other periods in *Saccolaimus* may merely mean that it breeds at other (fixed) seasons.

The records of foetuses thus matches the pairing times deduced from the presence of the crest.

In consequence of all this the subgenus *Lophomops*, as defined by Allen, must be given up. The crest (the only feature common to the species referred to it) is of general occurrence in *Chærephon*—indeed, it may be found in all members of that genus as rediagnosed by Thomas (Journal Bombay Nat. Hist. Soc. 1913, p. 90). It is apparently found throughout the race-circle *Chærephon pumilus*, its occurrence in *abæ* (which is probably a near relative of *major* and *emini*) suggests its occurrence in the last-named forms also, and in *johorensis* (the type of the genus) Dobson observed

that there is "at the base of the funnel-shaped anterior boundary" (i. e., the connecting membrane) "a few longer hairs . . . as in *Nyctinomus pumilus*" (Catalogue, p. 432). The seasonal occurrence of the tuft makes it an unreliable character to use in distinguishing forms, as long as the material of this genus available for study is not greater, because a negative find is not conclusive unless several males from different seasons are examined. If in spirit-specimens with well-developed scrotum, or in skins, where the scrotum is described on the label as having been well developed, no crest is found, then, of course, it may be inferred with a high degree of certainty that it is always lacking.

XXXVI.—*The Micrasoma Species (Trichoptera) of the French Pyrenees.* By MARTIN E. MOSELY, F.E.S.

THE separation of the species of *Micrasema* has always been a matter of difficulty to the Trichopterist. McLachlan writes of dry examples that "the anal parts are so short and concealed that their discrimination often becomes nearly impossible." No doubt it is for this reason that he recommends mainly characters of neururation for their determination, and consequently in his Monograph gives few characters derived from the genitalia.

Unfortunately neururation is not always constant in this genus, and individual variations frequently give rise to much difficulty when this character alone is available.

The species so far recorded in the French Pyrenees are *minimum* McL., *mæstum* Hagen., *morosum* McL., and *longulum* McL.*. Of these the first two are very small insects with expanses of $8\frac{1}{2}$ to 10 mm. in the male; the remaining two are somewhat larger, with expanses of 12 to 13 mm. in this sex. In all four species the females are much larger and vary considerably in expanse.

McLachlan fortunately gives good genitalia characters in respect of *minimum* and *mæstum*, and the males may be readily separated by the presence of a ventral spine in the former which is absent in the latter. The neururation of the female *minimum* is peculiar in the absence in the

* *M. nigrum* Brau., recorded by Despax in the neighbourhood of St. Bât, Haute-Garonne, and near Hautes-Pyrénées, proves to be *M. morosum* McL., and must be removed from the Pyrenean List. Monsieur Despax informs me that the determination was made from badly preserved material.

posterior wing of the upper cubitus and fork 5. This arrangement is, in fact, so unusual in the genus that McLachlan did not at first realize the association with the male *minimum*, and described the female as a distinct species under the name *exiguum*, and even expressed a doubt as to its being a true *Micrasema*.

The posterior wing of the female *mæstum* is normal, so that we have good and sufficient characters in each sex for the correct determination of the two species.

The position of *morosum* and *longulum* is less satisfactory. The only characters of any value given by McLachlan are the neurulation and the shape of the wings. He states that in *longulum* there is a long footstalk to the third apical fork, and that in *morosum* the fork extends to the nervule below the sector or is only separated therefrom by a minute space. But I have individuals of *longulum* from the Pyrenees (McLachlan's examples were from Saxony and Silesia) in which the footstalk cannot be described as long, and is sometimes so short as to approximate the "minute space" indicated as occasionally occurring in *morosum*; so that this character is not entirely reliable. More satisfactory is the character afforded by the shape of the wings, which are more elongate in *longulum* than in *morosum*.

Fortunately the examination of a long series of microscope preparations of the Pyrenean examples has brought to light far more satisfactory characters furnished by the genitalia and also by the relative lengths of the joints in the three-jointed male maxillary palpi. Although these vary slightly in proportion in different individuals, in all the species that I have examined, the basal joint is smaller and the terminal joint longer in relation to the middle joint as regards *morosum* than is the case in *longulum*. The intermediate appendages, inferior appendages, and the shape of the penis also furnish differentiating characters, and for convenience I will tabulate these characters in parallel columns.

I should add that, in the absence of an opportunity of examining the types, I have based my determination of *morosum* partly on McLachlan's statement that he had seen fifteen examples from various parts of the Basses-Pyrénées (whence came my own examples) and partly on neurulation, although I have failed to find any trace of the small discoidal cell which he mentions as occurring

Fig. 1.

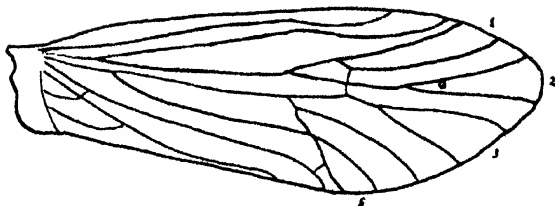


Fig. 2.

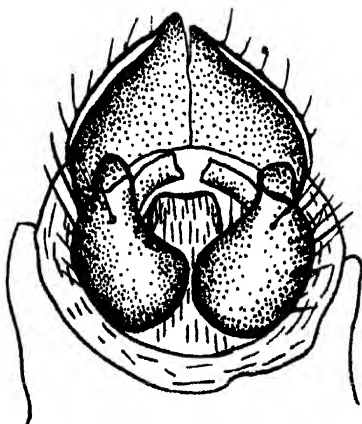


Fig. 3.



Fig. 4.



Fig. 5.

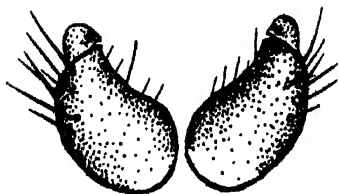


Fig. 6.



Microsema longulum McL., ♂.

- Fig. 1.—Anterior wing.
 Fig. 2.—Genitalia from beneath.
 Fig. 3.—Intermediate appendages.
 Fig. 4.—Penis from the side.
 Fig. 5.—Inferior appendages.
 Fig. 6.—Maxillary palpus.

Fig. 7.

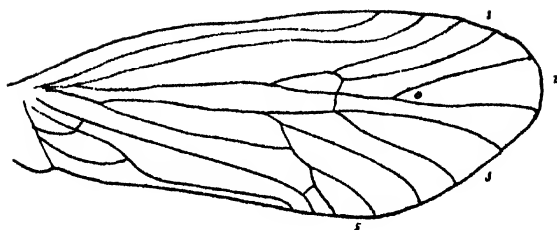


Fig. 8.

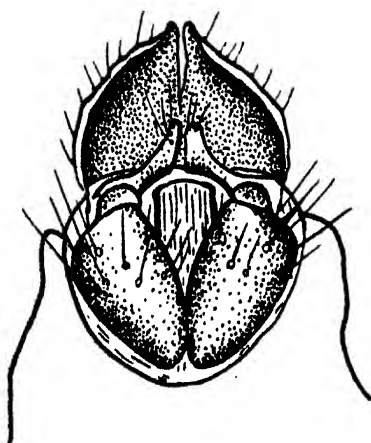


Fig. 9.



Fig. 10.



Fig. 11.

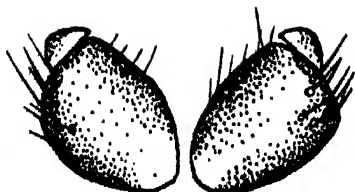


Fig. 12.



Micrasema morosum McL., ♂.

- Fig. 7.—Anterior wing.
 Fig. 8.—Genitalia from beneath.
 Fig. 9.—Intermediate appendages.
 Fig. 10.—Penis from the side.
 Fig. 11.—Inferior appendages.
 Fig. 12.—Maxillary palpus.

in the posterior wing in the Carinthian typical examples. My determination of *longulum* is based on the more elongate wings and the presence of the footstalk to fork 3 in nearly all the examples examined.

I have taken the four species at the following localities :—

minimum.—Pyrénées-Orientales : Quillan, Foix.

maestum.—Pyrénées-Orientales : Quillan, Foix. Basses-Pyrénées : Ixassou, St.-Jean-Pied-de-Port, Eaux-Chaudes.

morosum.—Basses-Pyrénées : Eaux-Bonnes, Eaux-Chaudes.

longulum.—Pyrénées-Orientales : Mont-Louis, Ax-les-Thermes, Olette, Foix.

I have also taken *minimum* in Cantal and the Vosges ; *maestum* in Cantal, the Vosges, and Lozère ; and *longulum* in the Vosges.

Characters of *longulum*.

Anterior wing Fork 3 generally with a footstalk.

Maxillary palpi, ♂.—Basal joint generally more than half the length and the terminal joint generally about the same length or only slightly longer than the median joint. The proportions of the joints vary slightly in individuals ; in the example figured they are basal joint 11, median 18, terminal 18 (6 = $\frac{1}{10}$ mm.)

Intermediate appendages.—No dilatation at the apices, which are truncate and slightly excised.

Penis from the side long and strongly arched

Inferior appendages reniform, upper margins sinuate ; terminal joint nearly as long as it is broad.

Characters of *morosum*.

Anterior wing.—Fork 3 generally sessile.

Maxillary palpi, ♂.—Basal joint generally less than half the length and the terminal joint always much longer than the median joint. The proportions of the joints vary slightly in individuals ; in the example figured they are :—basal joint 9, median 21, terminal 30. (6 = $\frac{1}{10}$ mm.)

Intermediate appendages.—Apices truncate and produced at their upper angles in two nearly rectangular, narrow processes directed upwards ; lower margin heavily chitimized.

Penis from the side short and nearly straight.

Inferior appendages ovate, upper margins convex ; terminal joint broader than it is long.

REFERENCES.

- DESPAX, R. 1928. 'Trichoptères observés dans les Pyrénées Françaises.' Bull. Soc. Hist. Nat. Toulouse, lvii, p. 69.
 McLACHLAN, R. 1874-1884. 'A Monographic Revision and Synopsis of the Trichoptera of the European Fauna,' pp. 259-265, pls. xxviii.-xxix., Supplement, pp. lv-lvi ; first Additional Supplement, pp. 25-26, pl. iii.

XXXVII.—*Notes on the Biology of Spiders.*—VIII. *Rare Spiders and the Meaning of the Word "rare."* By W. S. BRISTOWE, M.A., F.Z.S.

It would be easy to compile a list of British Spiders which are usually labelled "rare," and I propose to mention a few in the present paper with the object of showing that their rarity is often more apparent than real, and that our difficulty in finding them is frequently due to our ignorance of their biology. The word "rare" is, in any case, purely a relative term, impossible of exact definition and unsatisfactory owing to the different interpretations placed upon it by different people. If elephants had a density of fifty to the acre they would be described as "abundant," whilst mice which occurred in equal numbers in the same area might be labelled "common," and small spiders the size of a pin-head nestling at the vegetation's roots probably "rare." A simple calculation shows that each tiny spider on this acre would occupy on an average a territory of 970 square feet, or, say, one spider to every 970 grass clumps, so it would stand a fair chance of escaping capture entirely, as anyone who has had experience of "grubbing" at grass-roots can testify. Mr. C. E. Elton has suggested to me that we may ultimately speak of each species in terms of weight per acre, and he tells me that in areas where the common Wood-Ant (*Formica rufa*) abounds his preliminary calculations lead him to believe that the weight of these ants per acre would exceed that of the average weight per acre of human beings in Great Britain. There would, undoubtedly, be difficulties in this system, but it is not my intention here to do more than call attention to the need for some new means of describing quantities.

Male spiders cannot fly to their mates like moths; there is, indeed, no proof that they can detect her whereabouts until they pick up her scent by crossing her tracks, or touch a strand of her snare, or see her, so it stands to reason that "rarity" with any meaning other than locally rare would spell extinction. In the hypothetical case cited above of fifty small spiders in an acre field, we may question the likelihood of these spiders ever having an opportunity of propagating

the species. Assuming the sexes to be equal in numbers, the male would have to visit and explore no less than 1740 grass-tufts, on an average, before he found a female.

The lives of the adult males are often very limited (a fact which has helped to multiply the popular belief that most males are eaten by their wives), but after consideration it seems to me highly probable that amongst small spiders the males usually, or at any rate very often, have a longer natural life than is the case with their longer relations. Amongst the Linyphiidæ the males of the larger species (*Linyphia*) have to be sought at particular seasons, whilst the males of many of their small brethren (*Erigone*, *Leptyphantes*, etc.) can be found throughout the year, or at least during a much longer period. The fact that these smaller species appear to have an equally regular egg-laying season seems to show that this is attributable to male longevity. Similarly, the male *Segestriæ* and *Dysderæ* are very seasonal, whilst in their tiny allies, *Oonops*, the males can be found over a much longer period. In the Theridiidæ I can point to *Theridion pallens* for comparison with the larger species, whilst amongst the Argiopidæ the males of the relatively small *Pachygnatha* undoubtedly have a much longer span of life than the larger *Epeiræ*. In the foreign *Argiopes* and *Nephilæ*, where the males are dwarfs beside their wives (less than one-thousandth their bulk in the case of *Nephila*), it has been shown by Bonnet (Bull. Soc. Zool. Fr. 1929, p. 507) that the males are more numerous than the females. He has not proved that more males are born, but suggests that the occurrence of the larger numbers of adult males (noted by several observers) may be due to their reaching maturity much more quickly—mating, in fact, with the females of the previous generation, and thereby escaping many of the misadventures which overtake the longer-lived females. The males of large Mygalomorphs and Liphistiomorphs are noticeably scarce except at particular brief seasons, when their wandering habits may make them more conspicuous than their nocturnal burrow-frequenting females. All this leads me to suggest that small spiders are handicapped in their work of propagation, and that they must either be more numerous than their

larger relations, which is certainly the case in many instances*, or the males must be longer-lived so as to enable them to cover the relatively longer distances imposed on them, or, where the males are so very much smaller than the females, as in the case of *Nephila*, produced in greater numbers. The fact that all these premises are found in nature proves their importance to survival.

Actuaries provided with the necessary facts and estimates—size, female sedentary or wandering, proportion of sexes, length of adult male's life, distance he can travel in a day, etc., could calculate the minimum density for each species, and in some we might find this to be surprisingly high†. With such figures before us we might be able to provide plausible explanations of certain fauna changes. A conspicuous species might still appear to be common when only just above its minimum density, whilst extinction would follow only a slight fall in numbers due perhaps to a severe season or a change, apparently small, in the habitat wrought by man's work or other causes. The inter-relation of one creature with another is so intimate that the disappearance of a single species may have far-reaching effects on the others.

Some species are naturally more abundant than others, but the point of the remarks I have made above is to suggest that all must be at least moderately numerous locally, if they are true members of our fauna and are not stray imported specimens. Many kinds are very particular as to habitat, and our ignorance of their ecological requirements is sadly lacking. Their powers of dispersal vary and colonies are not to be found in every habitat which we consider rightly or wrongly to be suitable, but the fact remains, and experience bears this out, that when we do stumble on a stronghold we frequently find "rare" spiders to be common.

* In point of numbers *Leptyphantes tenuis* Bl., *Erigone dentipalpis* Wid., *H. atra* Bl., and other Linyphiids must be more numerous by far than any other British spiders.

† A digression—Prof. Jeans says, "leave only three wasps alive in the whole of Europe and the air of Europe will still be more crowded with wasps than space is with stars." Our nearest neighbour, the moon, is 239,000 miles away, the sun 93,000,000 and the nearest star 25,000,000 " ('The Stars in their Courses,' 1931).

EXAMPLES OF RARE SPIDERS WHICH ARE
COMMON LOCALLY.

For one reason or another many spiders have a very restricted range, and the credit for their first discovery is frequently due to their chance collection by a student of some other group. The interesting Malayan segmented spider, *Liphistius desultor* Sch., was represented by two specimens until I visited Penang in 1930, the locality in which the type was discovered in 1849. There, and subsequently on Kedah Peak and Krau in Upper Perak, I found it in abundance, and I must have seen well over a hundred burrows in the course of a few days' search. In the years intervening between its first discovery and my visit several naturalists had sought for it in vain. My success was due to no cleverness or skill on my part, but to experience of what to look for gained by Mr. H. C. Abraham's excellent description of the trapdoors made by an allied species in banks or other parts of Malaya.

Turning to British species, I give a few notes below to show, or at least suggest, that many of the so-called rare and uncommon kinds are common locally.

Atypus affinis Eich.

This species is described in fauna lists as "rare" or "uncommon," but in localities where its colonies do occur it is usually abundant. Near Bexhill I timed myself, and found that I saw no less than thirty-two nests in nine minutes. Elsewhere I record it from as many as forty-six localities in Great Britain (*vide* p. 289).

Segestria bavarica C. L. K.

I have collected this species in the Channel Islands (Guernsey and Jersey), on the Scilly Islands, and Lundy. Previous records exist for Portland and Ringstead only.

It builds tubes, rather similar to those of its smaller relation *S. senoculata* Linn., in walls and cliff-faces, and wherever I have found one I have found several others close at hand.

Oonops domesticus Dal.

Until 1921 this tiny species was confused with *O. pulcher* Templ. Now that we know where to look for it—creeping over the walls or ceilings of houses at night—it has been found in twelve localities divided between the eight counties—Surrey, Sussex, Hampshire, Middlesex, Norfolk, Devon, Worcester, and Oxford. At Littlehampton I found six in one room, and elsewhere I have seldom found less than three in one evening's search of a house in which I had found one. (In a previous paper I allocated Malvern wrongly to Glamorgan.)

Scytodes thoracica Latr.

This is another house-living spider in Great Britain, and I suspect that much of what I have said of *O. domesticus* would apply here if a thorough search of any house in which it is known to occur were made.

It is looked upon as being very rare, but the Rev. J. E. Hull had twelve specimens sent him from Studland a few years ago. In Majorca, where it lives under stones, I collected twenty in one day. In Great Britain it has been recorded from the Channel Islands, Kent, Sussex, Dorset, and Oxford.

Eresus niger Pet.

The known records for this beautiful species in order of date are as follows:—Dr. Leach, one male (locality and date uncertain); one male, 1874, Bournemouth; two males, Purley Heath, nr. Wimborne; one female, 1891, Poole sandbanks; one male, 1900, five miles from Bournemouth; Sark, Channel Islands.

The concentration of these records in one small area (excluding that for the Channel Islands) satisfies me that this species is, or at least was, endemic. The heathery slopes of the Bournemouth district, which we know from Continental collectors' experiences to be the sites most favoured by this species, have been much built over and it is quite possible that *Eresus* no longer exists there. But this is not certain, and naturalists should search for it in that district. The black females which reach a length of 15 mm. make burrows in the ground with a blackish matted web above the surface. The

scarlet males wander in search of their mates in April or May, so a search in these months would be most likely to reward the collector. It is significant that males represent five out of the six English records, as British searchers have not known the habits of the female.

Tarentula nemoralis Westr.

This species was added to the British list by P. F. Smith in 1907, who discovered it in the High Woods, near Bexhill. To our delight, Dr. Randall Jackson and I discovered a female near Colman's Hatch in June 1921. Having discovered one specimen we walked in different directions in search of more, and each collected eight in the space of half an hour. The sexes were evenly divided. Since that date we have discovered

Fig. 1.



Fig. 2.



Fig. 1.—*Tarentula nemoralis* Westr.

Fig. 2.—*Lycosa lugubris* Walck.

it in additional Sussex and Kent localities—Dr. Jackson near Folkestone and I in the original locality near Bexhill, as well as at Guestling, Hurstmonceux, and Mackam Down. Wherever it does occur it appears to be common. In the five localities in which I have found it, it frequents open spaces in pine and oak woods—along paths, in clearings, and especially on bare spots where no vegetation is growing. These localities are shared by *Lycosa lugubris* Walck., which resembles it in general appearance very closely, but the *Lycosa* extends under the trees and favours the less bare spaces where dead leaves are accumulated. When living females are placed side by side, the *Tarentula* (fig. 1) is seen to be brown and bluish grey, whilst the *Lycosa* (fig. 2) is brown and yellowish brown. Both have black shoulders to the abdomen, but in the former the space between is inclined to be pinkish. The black and white *Lycosa* male need not be confused with the *Tarentula*

male, which resembles his female more closely and has some white pubescence on his front legs. Under the microscope the sexual organs make the separation of these two species an easy matter.

In the Folkestone district, Dr. Jackson found *Tarentula nemoralis* Westr. on the chalky cliffs of the Warren, and in the field he confused it with *T. miniata* C. L. K.

Fig 3.



Fig. 4.



Fig. 5.



Fig. 3.—*Lycosa lugubris* Walck. Epigyne.

Fig. 4.—*Tarentula nemoralis* Westr. Epigyne.

Fig. 5.—*Tarentula nemoralis* Westr. Male palp.

on account of the species here being a hoary greenish white. This variety he has called *cretata*.

T. nemoralis becomes adult towards the end of May or in June, and the eggs are laid during the month following the second week in June. These are enclosed in a round white cocoon, in which the join of the two halves is visible, and this is attached to the spinnerets. When at rest she bends her body round it in her chelicerae. She usually retires beneath a stone or a lump of dead leaves or earth, where she lines a shallow chamber with

silk, so she is not to be seen running around with her eggs like *L. lugubris*, and I have found her sitting with her young clustered over her in these retreats in August.

L. lugubris differs from *T. nemoralis* in a number of biological points. This *Lycosa* has a longer season than most of its relatives, and can be seen carrying her eggs attached to her spinnerets (never in her chelicerae) from June till August. The egg-cocoon is dirty yellow in colour and somewhat flattened in shape. The mother never makes a retreat like the *Tarentula*. The males have all disappeared before the end of July, whilst *Tarentula* males can still be found in early August.

Micrommata virescens Clerck.

In spite of its size, this is looked upon as being an uncommon species, yet it has been found in a number of southern localities—Kent, Sussex, Hampshire, Isle of Wight, Dorset, Wiltshire, Berkshire, Bucks, Oxford, Lincolnshire, Northamptonshire, etc. It extends into Ireland and the Channel Islands, and northwards into Staffordshire, Lancashire, and Yorkshire. In localities where it is known to exist it usually appears to have been found sparingly, but this is due, I am convinced, to our ignorance of the ecological requirements. The following notes seem to support this view. In 1918 I found specimens at Caesar's Camp, near Wellington College, Berkshire. They were restricted to the tall coarse green grass which grows there between the clumps of Rhododendrons and in the clearings amongst the trees. Here they were quite common, and in the middle of July, when they laid their eggs, I could rely on finding as many as fifteen or twenty in two hours by looking on young oak-shoots a few feet in height, whose leaves the spiders fastened together to form a spacious chamber in which to lay and guard their eggs.

The males have a short life, once they are adult (which accounts for O. P. Cambridge and Dr. R. Jackson's references to their rarity), but I could always find several in the middle of June (elsewhere the season may be different, and O. P. Cambridge records finding one in Dorset on May 5th). Wanting specimens a few years later I described the exact spot to a lady who was not a naturalist, and she collected three males and four

females in an hour and a half. During and after the war this district was subjected to the ruthless felling of trees, and when I returned to the same spot in 1932 the grass was no longer sheltered by trees and the spiders had vanished. A few miles away the trees had grown up meanwhile and *Micrommata* had colonized the occasional grassy open spaces amongst them. Reference to ancient books shows that *Micrommata* used to inhabit Ken Wood, Hampstead, one hundred and fifty years ago, but now it has completely vanished and there are no sites in which I should expect to find it.

Bianor ænescens Sim.

Recorded from Hedley (Surrey) and the Forest of Dean (Gloucestershire). Dr. R. Jackson, who collected them in the latter locality in June 1920 amongst moss and heather, appears to have found them in abundance, for he says, "we got several adult males and a larger number of mature females," but "the majority of specimens were immature."

Wicken Fen has been preserved by the National Trust, and it harbours a fauna which no doubt existed over a large part of East Anglia before man drained it for agricultural purposes. In addition to many rarities, Wicken and adjoining fens can boast of four species peculiar to them, and three not known from any other locality in Great Britain. Many of these rarities are very common in the fen—*Lycosa farrenii* Camb., *Marpessa pomatia* Walck., *Clubiona subtilis* L. K., *Zora letifera* Falc., *Neon valentulus* Falc., *Thanatus striatus* C. L. K., *Tarantulus setosus* Camb., etc.

I could cite many other instances of spiders known from one or two localities which occur in tolerable abundance within their restricted range, but this is enough to illustrate my point. They may be particular as to habitat, and we may be ignorant of their ecological requirements or have failed to stumble on their headquarters, but there must be a limit to their rarity and they must be common locally.

IMPORTED SPECIMENS.

Many spiders are imported into this country annually,
Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 21

and my view, broadly speaking, is that those species which succeed in establishing themselves should be included in the British fauna list. Many of our species have undoubtedly come from abroad at some date, and if we were to go back far enough we might even hazard that very few indeed *originated* within the present boundaries of Great Britain. But what of the imported species which thrive in this country solely under artificial surroundings provided by hot-houses! There are quite a number at Kew and elsewhere, including *Ischnothyreus velox* Jacks., *Trieris stenaspis* Sim., and *Hasarius adansonii* Sav. These, I think, should form a list of their own, attached as an appendix to the main fauna list of Great Britain. The case of *Theridion tepidariorum* C. L. K. is different. It is found in most glass-houses throughout the country, both heated and unheated, and is to be met with in houses in south-western England.

The original home of some of our *Tegenaria* is uncertain, and it is an odd fact that *Tegenaria atrica* C. L. K., one of the commonest species in England to-day, has not reached Ireland, whilst *T. larva* Sim. is common in Ireland, but possesses only a single small colony in England at Southport, Lancashire. Both are common on the Continent.

A few spiders have been found once or twice* in Great Britain, and as yet there is little or no evidence that they are established here, although those of them which were found prior to 1900 were included in O. P. Cambridge's 'List of British and Irish Spiders.'

The large and striking *Segestria florentina* Ross. was found at Plymouth nearly a hundred years ago, and at Bristol in 1889. *Lithyphantes nobilis* Thor. was found in Torquay sixty years ago, but, except for a specimen sent me in 1928, which was known to have been imported with bananas from the Canary Islands where it is common, it has avoided further capture. A specimen of the striking *Argiope bruennichii* Sol. was sent to the British Museum from Sussex a few years ago, but I am satisfied that this southern European species is not established here. In 1920 I found a male Attid, *Euophrys lanigera* Sim., on the wall of a house at Budleigh Salterton, and in 1928 I found an immature Attid at Taunton in a similar situation, which I believe to be attributable to the same

species, but until further specimens are forthcoming I would not advocate its inclusion in our fauna list.

When a new list of British spiders is prepared I would advocate the following arrangement:—

(1) The spiders of Great Britain and Ireland.

(2) Those spiders recorded from the Channel Islands which are not known from the rest of Great Britain. These number eleven species. (Although included politically as part of Great Britain, geographically and climatically the islands have greater affinities with France.)

(3) The spiders restricted to our hot-houses.

(4) The imported spiders which have not, so far as we know, succeeded in becoming established in Great Britain.

XXXVIII.—*Notes on the Biology of Spiders.*—IX. *The British Species of Atypus.* By W. S. BRISTOWE, M.A., F.Z.S.

SYNONYMY.

We have no trap-door spiders in England, though *Atypus* is a member—indeed, our only representative—of the group to which they belong. The strange habits of this spider have attracted much attention †, so it is not a little surprising to find that doubt exists as to the number of species belonging to the genus occurring in Britain. Seeing that biological notes are of little value so long as there is uncertainty of the species involved, I am devoting the first part of this paper to my attempts to clear up the systematic position. Blackwall recorded and figured one species, *Atypus sulzeri* Latr., in the 'Spiders of Great Britain and Ireland.' In 1879 O. P. Cambridge recognized three species in the 'Spiders of Dorset' (*Atypus piceus* Sulz. (= *A. sulzeri* Latr.), *A. blackwallii* Sim., and *A. beckii* O. P. C.), but later, in his 1900 'List of the Spiders of Great Britain,' he reduced the number to two by making *A. blackwallii* Sim., a synonym of *A. piceus* Sulz., which by that time had itself been relegated to the synonymy of *A. affinis* Eich. To the view that *A. affinis* Eich. and *A. beckii* Camb.

† See in particular F. Enoch's papers in Trans. Ent. Soc. 1885, p. 329, and 1892, p. 21.

represented our quota he held until his death in 1917, his last reference to the subject being made in the Proc. Dorset Nat. Hist. and Antiq. F. C. for 1910: "In the Proc. Dors. N. H. and A. F. Club, 1908, p. 164, it is stated that *A. affinis* Eich. is the only British representative of the family. This was an oversight, as another species was found by the late Mr. Richard Black at St. Leonards, near Hastings (*Atypus beckii* Camb.)."

Prior to this date his nephew, F. O. P. Cambridge, had paid considerable attention to the subject, and in 1899 he said that he had compiled "a monograph as yet unpublished." His untimely death no doubt prevented publication being proceeded with and search amongst his papers has not brought the manuscript to light. We can, nevertheless, express the opinion that he arrived at the conclusions that *A. affinis* Eich. was our sole British representative of the genus, that *A. beckii* Camb. was a synonym of *A. piceus* Sulz., and that this had been recorded from Britain in error. My reasons for saying this are as follows:—

1. In the 'Victorian History of the Counties of England' F. O. P. Cambridge contributed a number of county lists, and in these he says that *A. affinis* Eich. "is the only example of the Mygalomorphæ found in the British Isles."

2. In one place he appears to throw doubt on Mr. Beck's record by saying that *A. beckii* Camb. was "supposed to have been taken at Hastings."

3. In O. P. Cambridge's private copy of 'The Spiders of Dorset' there is a pencil note recording that his nephew had made a minute examination of *Atypus* and that he (F. O. P. Cambridge) believed *A. beckii* Camb. to be a synonym of *A. piceus* Sulz.

F. O. P. Cambridge died in or about 1904, so it will be seen that O. P. Cambridge did not follow his views, and an examination of his collection provides a probable explanation. Any confusion that has occurred in England is nothing to that which took place on the Continent and of a male and female *Atypus* sent to O. P. Cambridge labelled "*A. piceus* Sulz." by E. Simon, the latter is correctly named, but the former is a typical *A. affinis* Eich., male. With this, no doubt, O. P. Cambridge

compared his *A. beckii* Camb., male, and came to the obvious conclusion that it was a distinct and unique species, and that there was little point therefore in assuming that Mr. Beek had collected it outside Britain, even though there was some doubt as to the locality. It should be mentioned in passing that an examination of F. O. P. Cambridge's collection shows that this was equipped with true *A. piceus* Sulz males provided by Continental collaborators.

At the time I started to make my investigation I was only aware of the fact that two species of *Atypus* were reputed to be British, and the contents of the last few paragraphs has emerged in the course of my researches.

My first step was to make myself thoroughly acquainted with the only two species now recognized as belonging to the French fauna, *A. affinis* Eich. and *A. piceus* Sulz., during a recent visit to the National Museum in Paris. Then, on my return to England, I examined all the specimens in my own collection, in the British Museum, and in the collections of the late O. P. and F. O. P. Cambridge in Oxford. As a result of this survey I can affirm that, with the exception of Mr. Beck's male, labelled "Hastings," all the British specimens in these collections belong to *A. affinis* Eich. Females from Portland attributed to *A. beckii* Camb. by O. P. Cambridge himself in the 'Spiders of Dorset,' as well as those attributed to *A. blackwallii* Sim., were examined and found to be *A. affinis* Eich. without any doubt. An examination of the *A. beckii* Camb. male showed with equal certainty that this is identical with the Continental *A. piceus* Sulz. There will probably always be doubt as to the synonymy of some of the earlier authors, but I am content to follow the lead set by the French arachnologists, and accept the names *Atypus affinis* Eich. and *A. piceus* Sulz.

Coming next to the validity of including *A. piceus* Sulz. in our British fauna list, I find myself in agreement with what I believe to have been F. O. P. Cambridge's opinion, that *A. affinis* is the only species which occurs in this country. The evidence for its inclusion rests on one specimen found over sixty years ago by a man who was known to have collected spiders on the Continent. Exactly what doubts F. O. P. Cambridge had we shall

probably never know, but these must have been shared to some extent by his uncle, since he wrote to Enock urging him to collect males at Hampstead in the following words:—"It might prove to be *A. beckii* as the late Richard Beck used to work Hampstead for spiders."

Even the date of capture is unrecorded, and a mistake in labelling may easily have occurred similar to that responsible for Blackwall ('Spiders of Great Britain and Ireland') recording *Atypus* from Carlisle, the home of the finder, but not, it is believed, the locality in which the spider was captured. Brown, Newman, F. P. Smith, Ruskin Butterfield, Sargent, and I myself have all collected *Atypus affinis* Eich. in the Hastings and St. Leonards district at different times, but all attempts to re-discover *A. piceus* Sulz. have failed, so I feel that there are adequate grounds for deleting it from our British List until or unless further specimens are collected. To simplify the task of identification, I give below some comparative notes based on my examination of a large number of each species.

NOTES ON THE IDENTIFICATION OF *ATYPUS AFFINIS* Eich. AND *A. PICEUS* Sulz.

Different authors have suggested characters to be used for the separation of these two species, but in the course of examining a large number of specimens I have found that few of these are reliable:—

1. *Thoracic Fovea*.—Bosenberg attempted to use this as a distinguishing character, but I cannot detect any marked difference. Nor could Simon (*vide* "Les Arachnides de France," tome vi. pt. 1, p. 23).

2. *Female Genital Organs*.—Kulczyński has shown that in *A. affinis* there are but two seminal pouches or spermathecae to each of the two genital openings, whereas in *A. piceus* there is a group of six or seven. Use of this character can only be made by cutting a section and examining the genital region as a transparent object.

3. *Male Palpal Organs*.—Separation of the males by this means is possible in typical specimens, but they are very liable to twist and get contorted in alcohol, so that this does not provide a ready means of identification.

4. *Eye Arrangement*.—The anterior median eyes are smaller and the eye-group more spread out in *A. piceus* (fig. 1) than they are in *A. affinis* (fig. 2). The anterior median eyes of *A. affinis* are not separated from the anterior laterals by more than their diameter, whereas in *A. piceus* they are.

Fig. 1.



Fig. 2.



5. *Groove on Patella*.—Simon attempts to separate the females by means of a groove which occurs on the outside of the patella of the first pair of legs. He says that in *A. piceus* this groove is bordered by a black chitinous band (fig. 3), whereas in *A. affinis* (fig. 4) it is not. In my experience (chiefly with specimens which have been in alcohol for some time) this fissure or groove is frequently white in both, but when black the species is invariably *A. piceus*.

Fig. 3.



Fig. 4.



6. *Membrane at Base of Chelicerae*.—Simon says that the membranous space at the base of the chelicerae is white or pale in *A. affinis* and dark or black in *A. piceus*. This is correct for *A. affinis* and usually, but not invariably, for *A. piceus*.

7. *Cheliceral Teeth*.—My experience leads me to believe that these and the eye-grouping referred to above are the surest means of separating the two species. Simon says that in *A. affinis* the cheliceral teeth are more evenly spaced, more numerous, and are uniformly black (as distinct from *A. piceus*, where they are only tipped with

black). I cannot agree that the teeth are more numerous in *A. affinis*, nor can I detect any noteworthy colour-difference in alcohol specimens.

The specimens on which I base my conclusions are as follows:—

Atypus affinis.—52 females from 18 different localities in Britain and 4 different countries in Europe (France, Austria, Holland, and Germany), 26 males from 14 different localities in Britain and the same 4 foreign countries.

Atypus piceus.—16 females from France, Austria, Germany, and Holland, 6 males from France and Germany.

Fig. 5.

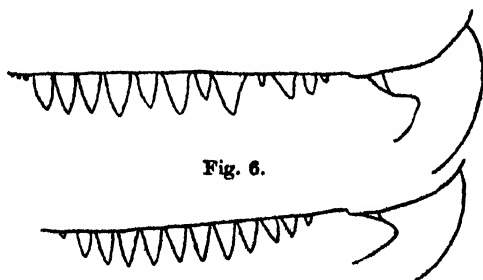


Fig. 6.

Females.

A. affinis (fig. 6).

A. Before leaving the mother's nest the young have 8 teeth. Adults usually have 11, occasionally 12 or even 13, and rarely 10. These lie on the interior border. In every specimen examined (except one, where it was missing) there was one tiny tooth on the exterior side close to the tip of the folded fang.

B. Sharp straight-sided teeth.

C. Closely and very evenly arranged. Regular in size except for the 2 terminal teeth.

A. piceus (fig. 5).

A. Adult's teeth much more variable in number—from 8 to 15. Usual number 10 to 12. Either 2 or 3 minute teeth on the exterior border (4 in two cases and 1 in two cases).

B. Teeth inclined to be blunter with more rounded sides and to extend their bases.

C. Never quite so evenly spaced or so regular in size. Usually 1, 2, or more small teeth interspersed amongst the big ones (on at least one of the jaws).

Males.

A. affinis (fig. 8).

A. One minute tooth on the exterior border as in the female. Usually 11 teeth on the interior border, never more, frequently 10.

B. Teeth not evenly arranged as in the female. The anterior 2 or 3 closely grouped or touching and bending forwards. The 4th (or the 5th where there are 11 teeth) and the one or two succeeding teeth clearly more widely spaced than the last four or five.

A. piceus (fig. 7).

A. Two or three minute teeth on the exterior border as in the female. Usually 9 or 10 teeth on the interior border.

B. Teeth not evenly arranged. The anterior 2 or 3 not touching or so closely grouped.

Fig. 7.

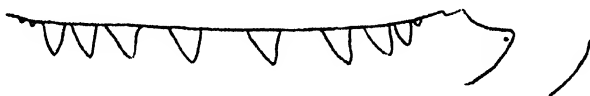
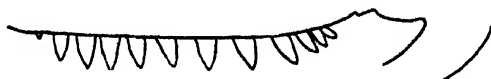


Fig. 8.



Having satisfied ourselves that there is only one species in Great Britain, we can proceed to a consideration of its distribution and biology.

DISTRIBUTION.

The genus *Atypus* extends in a belt round the world north of the Equator—North America, Europe, North Africa, and a number of the countries comprising Asia, some of which are just south of the Equator (Burma, Malaya, Java, Sumatra, China, Japan, etc.). In spite of having this wide range there are not a great many different species, and it may be said that they are most at home in the temperate and subtropical countries. Where they occur in tropical countries they favour chiefly the cooler situations met with in the hills and mountains, whilst at lower levels they reach cooler latitudes than any other member of the suborder Mygalomorphæ.

In Western Europe three species are recognized—*A. muralis* Bertk., *A. piceus* Sulz., and *A. affinis* Eich.

To what extent confusion still exists it is difficult to say, but it makes definite assertions of the known distribution still a little uncertain.

A. muralis Bertk. is restricted in range to Germany and Hungary.

A. piceus Sulz. has its headquarters chiefly in central Europe, Switzerland, Austria, Hungary, Czecho-Slovakia, Germany, Holland, France (where it is rare), and Southern Russia (Khargiz).

A. affinis Eich. is more widely distributed. In Denmark its most northerly point is reached, whilst it extends southwards into northern Africa (Algeria), Spain, and Portugal. Between these limits it is recorded from Britain, France, Germany, Austria, Hungary, and Holland.

Coming now to Britain, I propose to treat the known distribution of *A. affinis* Eich. in greater detail, and with this object in view I have attempted to make an exhaustive search amongst the published literature, and I have added additional records from my own collection, and also from those of the British Museum, the late O. Pickard Cambridge, and the late F. O. Pickard Cambridge. In addition, I have to thank Mr. H. Sargent of the Bexhill Museum for a list of a few Sussex localities (to some of which he took me in person) in which he has found *Atypus affinis* Eich. In the following list, which sets forth our present knowledge of the distribution of this species I have marked with an asterisk those localities in which I have myself found it, though in several cases others had assisted me to do so either by published or verbal information :—

ENGLAND.

Cambridge	Devil's Dyke.
Essex	Epping Forest.
Middlesex	Hampstead Heath.
Kent	St. Margaret's Bay *; Dartford; Pratt's Bottom, nr. Halstead; Tunbridge Wells.
Channel Islands	Guernsey *; Jersey; Alderney; Sark; Herm; Lihou; Houmet Hompholle.
Sussex	Hastings *; St. Leonards *; Bexhill *; Cooden *; Worthing; Pett; Guestling.
Surroy	Oxshott *; Wisley *; Wimbledon Common; Woking; Reigate; Addington, nr. Croydon.
Hampshire	Ventnor, I. of Wight.
Dorset	Swanage *; Worret, nr. Wareham; Bloxworth Heath; Portland; Winfrith; Hyde Heath; Lulworth.

Devon.....	Lundy Island *; Cleaubrook; Plymouth; Babacombe, nr. Torquay; Exeter.
Cornwall.....	Fowey; Polperro.

WALES.

Pembroke	Tenby.
Glamorgan	Swansea; Porthcawl.

IRELAND.

King's County.....	Geashill.
--------------------	-----------

This list shows that *Atypus affinis* Eich. is restricted to the southern counties of Great Britain.

BIOLOGICAL NOTES.

Without doubt, numerous other localities will be discovered in time in southern England, Ireland, and Wales, but it is very often a case of stumbling on them, as their colonies are not only restricted to certain types of soil which can be excavated with ease and do not get waterlogged, but for some reason less evident they are frequently stationed in small parts of what would appear to be a suitable area. Banks and slopes composed of sandy or friable soil are preferred, especially those with a southerly aspect, though these are not adhered to exclusively. It would seem that they do not flourish with the hot midday sun beating down on their burrows. In heath areas they like banks with overhanging heather and in Sussex lanes grass or other vegetation, though this is a generalization which is not always met with in practice. Thus the aerial portions of the tube will frequently be found amongst matted grass (Guernsey, Lundy) or heather foliage (Wisley, Oxshott), and sometimes under stones (Cornwall, Guernsey) or in chinks in cliffs near the sea (Guernsey).

The length of an adult *Atypus* tube varies, but the average is about eight or nine inches. The longest tube I have ever found measured eleven and a half inches, but F. Enock holds the record with one of fifteen and a half inches. The tube is completely closed, though the silk at the lower extremity is thin, which enables the spider to escape on occasions when one could otherwise capture it by pulling up the complete tube. I can hardly think that in other circumstances the weak extremity would benefit the spider in escaping from

enemies, and its true purpose probably lies in the access this affords to the particles of earth which it incorporates in the wall of the tube by forcing these into the silk from the inside, as Enock has shown to be the method employed. About one and a half to three inches of the tube extend above the surface of the ground like the fingers of a glove. Sometimes this hangs downwards, but normally it is directed upwards and is anchored by a few threads to a suitable support. The female never leaves her tube, and a certain amount of controversy has taken place as to its food-supply. Simon considered that they fed almost exclusively on earth-worms, whilst Berland was emphatic that earth-worms were not part of the spider's diet at all, and that it was dependent entirely on insects which crawl over the aerial portion of the tube †. There is no doubt, I think, that Berland's view is nearer the truth, as the spider will take insects placed on the exposed portion of the tube at any time of the day or night, and I have found the remains of beetles, bees, flies, earwigs, and wood-lice in their burrows. They will also accept small earth-worms, it is true, as I have found by experiment, and other spiders such as *Epeira diademata* and *Agelena labyrinthica* will do likewise, but owing to the nature of *Atypus*'s hunting methods such a meal in nature must, I think, be rare. She creeps up her tube until she is under her prospective prey, whose movements have attracted her attention, and strikes through the tube with her long fangs from an inverted position. Her next action is to pull the creature towards her, thereby making a concavity in the tube, and then to tear a hole in the fabric, through which it can be hauled. Such rough treatment is not very effective with the long soft wriggling body of an earth-worm. It tears under the strain, and in my experiments the only occasions on which the spider succeeded in enjoying a meal were those on which I made a hole in the tube myself and forced the worm inside in order to see whether the taste met with the spider's favour.

It is not uncommon to find branches forking upwards or downwards off the main tube, and the explanation of these is somewhat obscure. I do not recall ever having found these in young *Atypi*. Does the male make

† E. Simon, Ann. Soc. Ent. Fr. 1873, p. 114; L. Berland, Ann. Soc. Ent. Fr. 1923, p. 194.

separate quarters in which to live? It is more likely that he is killed shortly after mating. Is it a means of increasing the very limited hunting field? Had we concluded that earth-worms formed an important part of their menu we might have supported this view. Do tubes become unsuitable and necessitate the building of fresh sections, instead of a completely new tube which would force the spider to leave her nest? This was the explanation given by Enoch, and I can suggest none better. During the winter months the spider lies dormant. Rain and frost tend to damage the tube, and the normally inflated appearance of the exposed portion is lost. The tube collapses, the silk loses its elasticity, and with moisture its inner walls become temporarily and perhaps permanently cemented together. On the return of warmth in spring and activity on the part of the spider new branches are formed, I believe, to replace those parts of the tube which cannot be resuscitated.

Surprise is sometimes expressed at the rarity of males of this and other spiders, but the explanation is really quite simple. In many spiders the males resemble the females until the penultimate moult, when they show perhaps a slight swelling of the palpal tarsi. Then at the last moult they emerge in their true colours with their palps fully developed, and change their habits accordingly. Adult male *Atypi* will rarely be found in their own tubes (I have done so once) for the reason that once they become adult they venture forth in search of females never to return. This takes place at a very restricted time of the year when naturalists may not be on the look-out for them—the last half of September and October †. Search in the right localities at this season will reveal them wandering in the open or closeted with a female in her tube. When in the course of his search a male encounters the aerial portion of a female's tube he stops momentarily, as if petrified, and then taps rapidly with vibrating palps and legs. There is no response. He pauses and continues. Still there is no sign of movement from within and presently he tears the tube with his chelicerae and enters. Simple though these preliminaries may

† On what are probably rare occasions they have been found at other times—one on June 6th and another on August 8th by Mr. H. Sargent at Questling, for instance.

seem they are of the utmost importance. His drummings are comparable to the jerks and tweaks given by male Epeirids and Theridiids to their females' snares. These drummings, jerks, or tweaks, as the case may be, have a strange effect on the female. She does not rush forth to kill as is her wont in response to other vibrations. She realizes the very first time she experiences them that these vibrations are different, and, in spite of the fact that she has neither seen, touched, nor smelt him, their repetition causes her sexual instincts to dominate her preying ones. She has inherited, as it were, the power to translate the Morse Code signalling of her race, whilst he has inherited the power to perform it in response to the scent of her threads. She is a "killer" by nature, and a conflict takes place within her between the instincts to kill and to mate. She may make a half-hearted onslaught upon him, but finally her sexual instinct prevails and she submits to his embrace. Should she be pregnant and unwilling to mate, his early advances are repulsed by the female *Atypus* giving a sharp tug at the tube, a warning signal which he understands, for on such occasions he usually turns in search of another.

A male and female placed on the floor of a cage together fail to interest one another. He touches her and retreats. She attempts to kill him. He has not received the initial stimulation of contact with her tube, which is the first in his series of reactions, whilst she has not had his telegraphic message. Meeting under such circumstances the instincts to prey and of fear remain predominant.

So much I have seen. His retirement into her silken burrow has concealed the further actions of the pair from me, but Prof. U. Gerhardt of Halle has recently succeeded in watching the subterranean habits of an allied species, *A. muralis* Bertk. †, by persuading the female to spin her tube in a glass tube. In the absence of earth to make it opaque it was possible for him to see all that went on within. The drumming with palps and legs prior to his entering the tube may continue for some little time and then the male exudes a large drop of saliva on the tube, which presumably has the effect of softening it. The male's serenade affected the female quite obviously, and Gerhardt noticed that her vulva

† Zeitschr. f. Morphol. u. Ökol. der Tiere, 14 Band, 3 Hefr. 1929, p. 728.

protruded and rolled outwards and open. Once he had forced his way into the tube the male ran rapidly up and down and then came to rest opposite the female, who had by then been stimulated to a state of submission. With his legs and partially opened chelicerae he pressed her flat against the tube-wall so that her ventral surface faced him, whilst he, facing in the opposite direction, pressed the ventral surface of his abdomen against the opposite wall and reared his cephalothorax so as to enable him to press his palp into her vulva. The palps were inserted alternately with the bulb extended outwards and backwards, and with the conductor as well as the embolus introduced into the vulva. Unlike most other spiders the palps were inserted into the corresponding genital opening (*i. e.*, the right palp into the right opening and the left into the left), whilst the insertion of the conductor would suggest that this structure found in the *Atypidae* (but absent in most other *Mygalomorphae*) is not homologous with the conductor of other spiders. In the *Atypidae* it serves as a protection to the embolus in the ordinary way, but at copulation it helps no doubt to open up the entrances to the spermathecae. Gerhardt's observations show that the mating habits of *Atypus* differ in several respects from those of the *Mygalomorphae* whose habits are known. Thus one distinct series of insertions is followed by a second series after a pause, the insertions are longer, and there are rhythmic swellings of the bulb similar to those found in entelogyne spiders.

The timing of the copulation gave the following results :—

1st Series.—*Left*, 8 mins. 5 secs.; *Right*, 20 mins. 5 secs.; an interval of 50 secs.; *Right*, 20 secs.; abortive attempt with *Right*; *Left*, 7 mins. 15 secs.; *Left*, 25 secs.

2nd Series (half an hour later).—*Left*, a few seconds; *Right*, 9 mins.; *Left*, 3½ mins.; *Right*, twice for a short time; *Left*, twice for a short time.

The female remained passive throughout except at the moment of palpal extraction, which necessitates a violent wrench by the male.

It would appear from Enock's extensive observations, which are confirmed by my own, that eggs are laid in the summer months eight or nine months after the copulation. These number about 100 to 150 and are enclosed in a white

silken sac attached by a silken cord or band to the upper side of the terminal chamber of the tube in which the female sits. The young hatch in autumn and leave their mother's care on sunny days in the following spring (March and April), approximately eighteen months after the original copulation! This surprisingly long period prepares us for the slow rate of growth and longevity which is found in this species. Maturity is not reached until the spiders are about four years old, eggs are laid and young are guarded during the next year and a half, and the female clings to life in certain instances at least for another two or three years, making a total of seven or eight years. I have no doubt that this period is frequently exceeded, and I once kept a female for five years after she was full grown.

I am indebted to Prof. E. B. Poulton for granting me access to the O. P. and F. O. P. Cambridge collections at Oxford, and to the authorities at the British Museum for leave to examine specimens in their Collection.

XXXIX.—*Diplostomum azimi*, sp. n., a new Trematode Parasite of the Dog. By NAZMI GOHAR, M.R.C.S. Eng., L.R.C.P. Lond., Assistant Lecturer in Parasitology, Faculty of Medicine, Cairo.

(From the Department of Parasitology, Egyptian University.)

THIS parasite was found by Dr. M. A. Azim of the Research Institute, Cairo, in the small intestine of an experimental dog, together with *Heterophyes heterophyes* (v. Siebold, 1852) and *Prohemistomum spinulosum* Odhner, 1913. One week before being sacrificed, the dog was fed on fish, *Mugil cephalus*, the second intermediate host in Egypt of *H. heterophyes* as ascertained by Prof. Khalil Bey.

Diplostomum azimi, sp. n.

Host.—*Canis familiaris*.

Habitat.—Small intestine.

Locality.—Cairo, Egypt.

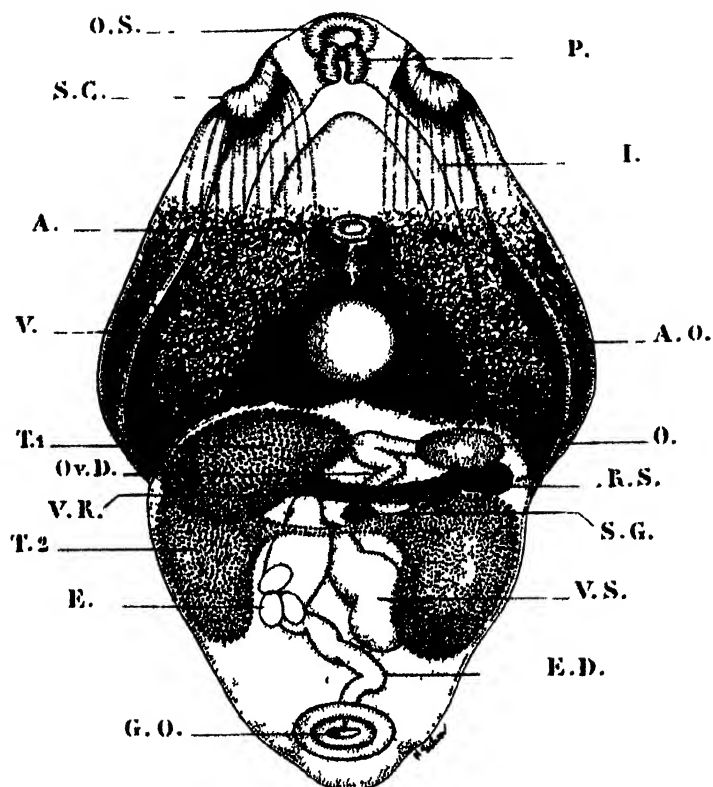
The body whose surface is devoid of spines or scales, which may have fallen off during preparation, is divided by a slight constriction into two equal parts, an anterior

ventrally concave part with its sides rolled medially and a posterior conical part narrowing down towards the posterior extremity, where it ends bluntly at the genital atrium.

In length the parasite is 2.2 mm., with a maximum breadth of 1.3 mm. just anterior to the junction between the two portions of the body. The oral sucker, measuring 0.18 mm. in diameter, projects a little anteriorly, and is flanked on either side by a suctorial cup, ear-like in shape, 0.2 mm. in length and 0.12 mm. in breadth. Immediately behind the oral cavity, a pharynx 0.12×0.11 mm. in size follows without the intervention of an oesophagus, the intestinal canal bifurcating directly into two caeca, which swerve posteriorly and laterally. Beyond the level of the acetabulum where the vitelline follicles end anteriorly, the course of the caeca could not be traced. About the middle of the fore body is the ventral sucker, 0.12 mm. in diameter, and posterior to it, just above the junction of the fore with the hind body is situated a globular adhesive organ with an opening 0.24 mm. in diameter. Converging at the suctorial cups are numerous delicate excretory vessels and muscular strands, whose course posteriad is obscured by the vitelline follicles. The hind body is occupied by the genitalia.

The Male Genital Organs.—Occupying almost the whole of the right half of the anterior third of the hind body is a pear-shaped testis, lying with its longer axis directed obliquely antero-posteriorly and to the right, the narrower pole being anterior and exactly in the middle line. The longest measurement of this testis is 0.5 mm. and the maximum breadth towards the base is 0.3 mm. On either side of the middle third of the hind body is a more or less oval lobe joined anteriorly to its fellow of the opposite side by a thin strand of testicular tissue, both constituting the second testis. The right lobe is 0.4 mm. in length and 0.3 mm. in breadth, while the left is 0.5×0.3 mm. in size. Between them they accommodate a centrally placed, voluminous, convoluted seminal vesicle, which narrows in girth as it proceeds to the genital opening.

The Female Genital Organs.—The ovary, which is oval in shape, lies with its longer axis transversely in the extreme left and anterior part of the hind body, and measures 0.23×0.11 mm. Posterior to it and to the



Diplostomum tregenna, sp. n. Ventral view, \times ca 50.

- | | |
|-------------------------------|-----------------------------------|
| <i>A</i> Acetabulum. | <i>P</i> Pharynx. |
| <i>A.O.</i> Adhesive organ. | <i>R.S.</i> Receptaculum seminis. |
| <i>E</i> Egg. | <i>S.C.</i> Suctorial cup. |
| <i>E.D.</i> Ejaculatory duct. | <i>S.G.</i> Shell gland. |
| <i>G.O.</i> Genital opening. | <i>T. 1.</i> Anterior testis. |
| <i>I.</i> Intestine. | <i>T. 2.</i> Posterior testis. |
| <i>O.</i> Ovary. | <i>V.</i> Vitellaria. |
| <i>O.S.</i> Oral sucker. | <i>V.R.</i> Vitelline reservoir. |
| <i>Ov.D.</i> Ovarian duct. | <i>V.S.</i> Vesicula seminalis. |

left is placed a seminal receptacle of about the same size. Taking origin apparently from the dorsal surface of the ovary, the oviduct runs transversely to the middle line and then bends acutely to the shell-gland, which lies immediately anterior to the connecting strand between the two lobes of the posterior testis. Running transversely anterior to the shell-gland is a fairly broad elongated vitelline reservoir. The vitelline follicles are spread over the fore body from its union with the hind body up to the level of the ventral sucker, where they cease abruptly. They lie in denser circumscribed masses around both the acetabulum and adhesive organ. No trace of them could be discerned in the hind body. The eggs, 0.12×0.072 mm. in size, are thick-shelled and yellowish in colour. Their condition did not allow for observing the opercula, but a granular miracidium could be made out within. The termination of the uterine canal is joined by the ejaculatory duct, both forming a common passage, narrow and short, ending in the genital opening, which is 0.08 mm. in diameter.

Systematic Position and Relationships.—The above-described Trematode belongs to the genus *Diplostomum* (*sensu* Hughes, 1929), family Strigeidae Railliet, 1919, differing from all the known species of this genus in the extremely lateral position of the ovary, which lies very far removed from the anterior testis and on the opposite side. This feature cannot be attributed to flattening or otherwise of the body. The only species to which it bears any important point of resemblance is *D. tregenna* Nazmi, 1932, and that is only in the shape and position of the posterior testis. The following is a list of the members of the genus *Diplostomum* :—

- Diplostomum spathaceum* (Rud., 1819) Hughes, 1929.
- *excavatum* (Rud., 1803) Hughes, 1929.
- *trilobum* (Rud., 1819) Hughes, 1929.
- ? — *intermedium* (Johnston, 1904) Hughes, 1929.
- ? — *triangulare* (Johnston, 1904) Hughes, 1929.
- *gavium* (Guberlet, 1922) Hughes, 1929.
- *indistinctum* (Guberlet, 1923) Hughes, 1929.
- *confusum* (Krause, 1914) Hughes, 1929.
- *huronense* (La Rue, 1927) Hughes, 1929.
- *clavatum* v. Nordmann, 1832, Ciurea, 1928.
- *pusillum* (Dubois, 1927) Nazmi, 1932.

Diplostomum colymbi (Dubois, 1927) Nazmi, 1932.

— *flexicaudum* (Cort & Brooks, 1928) van Haitsma, 1931.

— *iregenna* Nazmi, 1932.

Note.—The author's name has been changed from M. Nazmi to Nazmi Gohar.

LITERATURE.

- BRANDES, G. (1890.) "Die Familie der Holostomiden." Zool. Jahrb., Abt. f. Syst. v. pp. 549-604.
- CIUREA, I. (1928.) "Sur une nouvelle *Procalaria* et sa métacercarie." Académie roumaine, Bull. Sect. Scient. XIème année, no. 9/10.
- (1929.) "Sur une Infestation Parasitaire de la Carpe causée par la Métacercarie d'un Trématode du genre *Neodiplostomum* Railliet." *Ibid.* XIIème année, no. 1/2.
- (1930.) "Contribution à l'étude morphologique et biologique de quelques Strigéidés des oiseaux ichthyophages de la faune de Roumanie." Arch. roum. de Pathol. Expér. T. iii. no. 3 (Septembre 1930).
- DUBOIS, G. (1927.) "Description de nouveaux trématodes d'oiseaux du genre *Hemistomum*." Bull. Soc. neuchâtel. Sci. nat. lii. pp. 33-44.
- GÜBERLEIT, J. E. (1922.) "Three new Species of Holostomidae." J. Parasit. ix. pp. 6-14.
- (1923.) "*Hemistomum confusum*, a Homonym." Trans. Amer. Microsc. Soc. xlii. p. 1, Jan.
- HUGHES, R. C. (1929.) "Studies on the Trematode Family Strigeidae (Holostomidae).—No. XIV. Two new Species of *Diplostomula*." Occasional Papers of the Museum of Zoology, University of Michigan, no. 202.
- JOHNSTON, S. J. (1904.) "Contributions to a Knowledge of Australian Entozoa.—No. III. On some Species of Holostomidae from Australian Birds." Proc. Linn. Soc. N.S.W. part 1, April 27th, pp. 108-116.
- KHALIL, M. (1924.) "The Source of Infection with *Heterophyes heterophyes* in Egypt." 'The Lancet,' vol. c cvi. p. 952.
- KRAUSE, R. (1914.) "Beitrag zur Kenntnis der Hemistominen." Zeitschr. wissenschaft. Zool. Bd. cxii. Heft 1, pp. 93-238.
- LA RUE, G. R. (1926.) "Studies on the Trematode Family Strigeidae (Holostomidae).—No. II. Taxonomy." Trans. Amer. Microsc. Soc. vol. xiv. no. 1.
- (1926.) "Studies on the Trematode Family Strigeidae (Holostomidae).—No. III. Relationships." Trans. Amer. Microsc. Soc. vol. xiv. no. 4, pp. 265-281.
- (1927.) "Studies on the Trematode Family Strigeidae (Holostomidae).—No. V. *Procalaria huronensis*, sp. n." Trans. Amer. Microsc. Soc. vol. xvi. no. 1, pp. 26-35.
- NAZMI, M. (1932.) "*Diplostomum iregenna*, sp. n., a new Trematode Parasite of the Egyptian Kite." Ann. & Mag. Nat. Hist. ser. 10, vol. ix. pp. 567-573.
- VAN HAITSMAN, J. P. (1931.) "Studies on the Trematode Family Strigeidae (Holostomidae).—No. XXIII. *Diplostomum flexicaudum* (Cort & Brooks) and Stages in its Life-history." Papers of the Mich. Acad. Sci. Arts & Letters, vol. xiii. (1930).

XL.—Reports on the Percy Sladen Expedition to some Rift Valley Lakes in Kenya in 1929.—V. Copepods from the Rift Valley Lakes in Kenya. By A. G. LOWNDES.

THE following paper gives an account of the freshwater Copepods from the Rift Valley Lakes in Kenya collected by Miss P. M. Jenkin in 1929. Miss Jenkin has already given a fairly full account (4) of the nature of the district and the lakes from which the samples were taken.

Altogether I received forty-five tubes of specimens ; of these some thirty-five or so contained those Copepods which Miss Jenkin had already sorted out, and the other tubes contained most of the Entomostraca, as they were collected. In many cases alcohol had been used as the preservative, and some of the samples were quite dry at the time of examining them owing to its having evaporated, while in one or two cases the bottles were broken. I took those samples which had dried up, and soaked them in alcohol, but with very little success.

Twelve species were identified, and of these one was new to science while four were well-known European species.

Two years ago I had the opportunity of examining the Copepods collected by Mr. J. Omer-Cooper from Abyssinia. Many of the collecting-stations there, as in Kenya, consisted of extremely alkaline crater-lakes, and a comparison of the Copepods from the two districts should prove of considerable interest. Of the twelve species recorded from Kenya eight were recorded from Abyssinia. The number of species is small, and of these several were very poorly represented.

Leptocyclops agilis (Koch) and *L. gibsoni* (Brady) are among the commonest species of both South and Central Africa, and yet a very few specimens of each were obtained.

One of the most remarkable features of the collection is the entire absence of Harpacticoids. Some of the tubes contained plenty of algæ and mud. Other tubes contained large numbers of small Cyclopoid nauplii. The mud and algæ would indicate that the right type of habitat had been investigated, while the presence of nauplii shows that the collecting had been done with a net of sufficiently fine mesh to catch the Harpacticoids had they been there.

I wish here to express my thanks to Miss Jenkin for giving me the opportunity of investigating this interesting collection.

LIST OF SPECIES.

<i>Paradiaptomus barnardi</i> (Sars).	<i>Mesocyclops obsoletus</i> (Koch).
— <i>biramata</i> Lowndes.	— <i>neglectus</i> (Sars).
<i>Diaptomus neumanni</i> C. van Douwe.	<i>Cryptocyclops pachycomus</i> (Sars).
<i>Leptocyclops agilis</i> (Koch).	— <i>bicolor</i> (Sars).
— <i>prasinus</i> (Fischer).	— <i>jenkinsæ</i> , sp. n.
— <i>gibsoni</i> (Brady).	<i>Platycyclops rubescens</i> (Brady).

The following table gives the names of the collecting stations and the names of the species which occurred at each :—

Lake Elmenteita.....	<i>Paradiaptomus biramata</i> (collected by Mr. R. E. Dent, 20. x. 1925).
Crater Lake	<i>Diaptomus neumanni</i> .
	<i>Mesocyclops neglectus</i> .
Lake Baringo	<i>Diaptomus neumanni</i> .
	<i>Mesocyclops obsoletus</i> .
	— <i>neglectus</i> .
	<i>Cryptocyclops pachycomus</i> ? (two specimens).
Lake Naivasha	<i>Diaptomus neumanni</i> .
	— <i>neglectus</i> .
	<i>Leptocyclops agilis</i> .
	<i>Platycyclops rubescens</i> .
	<i>Cryptocyclops bicolor</i> .
	— <i>jenkinsæ</i> , sp. n.
River Makalia.	<i>Mesocyclops obsoletus</i> .
	— <i>neglectus</i> .
	<i>Leptocyclops agilis</i> .
	— <i>prasinus</i> .
	— <i>gibsoni</i> .
	<i>Platycyclops rubescens</i> .
Lion Hill Pond	<i>Paradiaptomus barnardi</i> ? (one specimen).

DESCRIPTIONS OF THE SPECIES.

Paradiaptomus barnardi (Sars).

Syn. *Lovenula barnardi* Sars.

Unfortunately only one specimen of this interesting species was obtained. The species has been recorded by Sars from South West Africa (II) and by Lowndes from Mt. Elgon, Uganda (8).

Paradiaptomus biramata Lowndes.

This interesting species has previously been recorded only from two of the Crater Lakes of Abyssinia. Numerous specimens were obtained from Lake Elmenteita in a

collection made by Mr. R. E. Dent in 1925, and now identified for the first time; but none were found during Miss Jenkin's investigation in 1925, when the lake was apparently at its lowest level and the alkalinity was at a maximum.

The use of the generic names *Lovenula*, *Paradiaptomus*, and *Diaptomus* for these African species has been fully discussed recently by Gurney (2, 3).

Diaptomus neumanni C. van Douwe.

This species is one of the most abundant in the collection. It was found to occur in Lakes Baringo and Naivasha, as well as from the much more alkaline Crater Lake. The species has been recorded by C. van Douwe from East Africa (1).

Leptocyclops agilis (Koch).

This species is of world-wide occurrence. The form here recorded would have been referred till recently to the species *Cyclops agiloides* Sars, but quite recently it has been shown that it really belongs to the well-known European species (9). The species is recorded from practically all parts of Africa. Curiously enough, very few specimens were observed in the present collection.

Leptocyclops prasinus (Fischer).

This species is of almost world-wide occurrence. Recently Kiefer (6) has attempted to divide the species, but I have shown elsewhere that at present such a division is unsatisfactory (9). Very few specimens were obtained, and these only from the R. Makalia.

Leptocyclops gibsoni (Brady).

This is a well-known African species and occurred very abundantly in the Abyssinian Lakes. Only a very few specimens were obtained.

Mesocyclops obsoletus (Koch).

This species is practically cosmopolitan in its distribution. Structurally it is almost unique among *Cyclops* (sensu lat.) in possessing no seta or spine on the inner corner of the second basal segment of the first swimming-foot in the female.

Mesocyclops neglectus (Sars).

This species was first recorded by Sars (10) from Lake Nyasa. It occurs in practically all parts of Africa. It was very abundant in the Abyssinian collections, and it is far and away the most abundant species in the present collection. The species has also been recorded from Senegal, Sumatra, and Germany.

Cryptocyclops pachycomus (Sars).

Syn. *Cyclops pachycomus* Sars.

Only two specimens of this interesting species were obtained and both were badly preserved. The species has been recorded from Tanganyika and the Upper Nile.

Cryptocyclops bicolor (Sars).

Syn. *Cyclops bicolor* Sars.

This is a very well known European species, and is recorded from practically all over the world. Specimens were very numerous in the present collection.

Cryptocyclops jenkinsi, sp. n.*Description of adult female.*

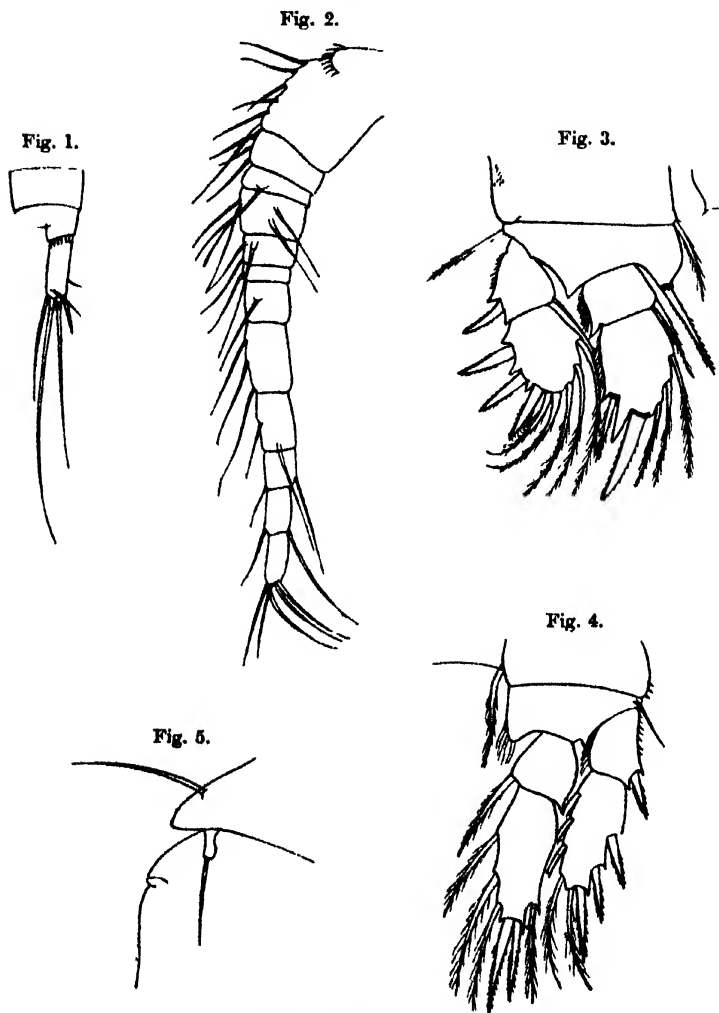
Length 1.0 mm.

The species is closely related in appearance to the European species *Cryptocyclops varicans* Sars, but it differs in several points.

The caudal rami are slightly shorter than the last two segments together and are three times as long as broad. The terminal setæ on the rami afford the most conspicuous difference. Taking the caudal rami as 100, measured along their outer edge, the other setæ starting with the inner corner give the following measurements: 184, 580, 383, 68. Thus the inner corner seta is nearly twice the length of the rami, while the outer is considerably shorter (fig. 1).

The anterior antennæ are 12-jointed, with the eighth joint the longest. These antennæ are quite short and well supplied with setæ, of which, however, none are conspicuously long (fig. 2).

The first foot.—The outer corner of the first basal joint bears a number of spinules. The spine on the inner corner of the second basal joint is stout and long and



Cryptocyclops jenkinsi, sp. n.

- Fig. 1.—Caudal ramus with setae.
Fig. 2.—Anterior antenna.
Fig. 3.—First swimming-foot.
Fig. 4.—Fourth swimming-foot.
Fig. 5.—Fifth foot.

borne on a rather conspicuous process. The terminal spine on the second joint of the inner ramus is conspicuously stout (fig. 3). In the *second* and *third feet* the spinules on the first basal joint are rather more conspicuous, those on the third foot being quite long.

Fourth foot.—The first basal joint bears three spinules on its outer corner. The second joint of the inner ramus bears terminally two subequal spines (fig. 4). Spine formula 3 . 4 . 4 . 3.

The fifth foot.—This consists of a single joint, somewhat swollen at both ends and bearing terminally a single seta (fig. 5).

The species is at once distinguished from all other species of the genus with 12-jointed antennæ by the length of the inner corner seta on the caudal rami, the fifth foot, and the spinules on the swimming-feet. I have great pleasure in naming this species after the collector Miss Jenkin, and only regret that there were not more specimens obtained.

Only three specimens were obtained, all from the region of *de'aying débris* near the east shore of L. Naivasha (Station VI.) (cf. Jenkin (4), pl. xviii. fig. 2).

Platycyclops rubescens (Brady).

This very characteristic species was first described by Brady from Natal. Kiefer (5) does not recognize this as a separate species, and gives it as a synonym of *P. phaleratus* Koch.

The specimens obtained from Kenya are identical with those from Abyssinia, and are at once distinguishable from the European species. Several specimens were obtained from Lake Naivasha and the River Makalia.

BIBLIOGRAPHY (chief references only).

- (1) DOUWE, C. VAN. "Ost-afrikanische Süßwasser-Copepoden." Zool. Jahrb. Jena. Syst. xxxiii. 1912.
- (2) GURNEY, R. "Notes on the Diaptomids of South Africa." Ann. & Mag. Nat. Hist. (10) iv., Dec. 1929, p. 572.
- (3) ——. 'British Freshwater Copepoda.—Vol. I.' Ray Society, 1931.
- (4) JENKIN, P. M. "Reports on the Percy Sladen Expedition to some Rift Valley Lakes in Kenya in 1929." Ann. & Mag. Nat. Hist. (10) vol. ix. June 1932, p. 533.
- (5) KIEFER, F. 'Das Tierreich,' Lief. 53. Crustacea, Copepoda 2, Cyclopoida, Gnathostoma. Berlin, 1929.

- (6) KIEFER, F. "Die Untergattung *Trophocyclops* der Gattung *Eucyclops* (Copepoda Cyclopida)." *Zeitschrift für wissenschaftliche Zoologie*, Bd. cxxxviii. Heft 3, p. 560. Akad. Verlag. Leipzig, 1931.
- (7) LOWNDES, A. G. "Freshwater Copepoda from Abyssinia collected by Mr. J. Omer-Cooper." *Proc. Zool. Soc. London*, 1930, p. 161.
- (8) —. "A Small Collection of Entomostraca from Uganda, collected by Mr. G. L. Hancock." *Proc. Zool. Soc. London*, pt. 4, 1931, p. 1291.
- (9) —. "The Results of Breeding Experiments on the Genus *Leptocyclops* G. O. Sars, with some General Notes on the Results of Culture Experiments." *Ann. & Mag. Nat. Hist.* (10) x. p. 45, July 1932.
- (10) SARS, G. O. "Zoological Results of the Third Tanganyika Expedition.—Copepoda." *Proc. Zool. Soc. London*, 1909, p. 31.
- (11) —. "Freshwater Entomostraca of the Cape Province.— Part 3. Copepoda, 1927." *Ann. S. Afr. Museum*. xxv. p. 85.

XLI.—*A Contribution towards a Knowledge of the Thysanopterous Genus Haplothrips* Serv. By RICHARD S. BAGNALL, D.Sc., F.R.S.E.

THE genus *Haplothrips* comprises many species, and has a wide distribution and a large range of host-plants with, perhaps, a preponderating leaning towards the Compositæ and Graminæ.

The species lack striking characters and are undoubtedly difficult to the student, though Priesner's recent work has enabled us to survey the genus with a better understanding.

In his 'Die Thysanopteren Europas' (1926–1927) Priesner gives a table of the European species of *Haplothrips* (then numbering over thirty species), which suggests workable divisions and subdivisions, whilst in 1931 he published "A Review of the African *Haplothrips*-Species" (*Bull. Soc. Roy. Ent. d'Egypte*, 1930, pp. 230–277, figs.), in which he carries the subject further, describing a number of new species and giving tables of the subgenera and of the known African species (numbering about three dozen).

I was thus tempted to work out *Haplothrips*-material in my possession, more particularly some English species (*marrubiiicola*, *juncicola*, and *senecionis*, spp. n.), which I described in the *Ent. Mo. Mag.* 1932, lxviii. pp. 163–165; the bulk of a not unimportant collection I made in the South of France, and some odds and ends from Czecho-Slovakia and the Sudan, which are described and recorded herein.

From this study I soon found that a number of species had the wing-cilia "feathered" or setulose, as described by Maltbaek in his *plumociliatus* (Soc. Scient. Fenn. Comm. Biol. 3, xvi. p. 3, figs. 1-3), and that this character had been overlooked by previous workers. It is, as yet, impossible to say how far this character can be used in taxonomy, but from material at my disposal it would seem that the setulose condition of the wing-cilia is a character confined to certain groups only, or, conversely, that well-defined subdivisions, such as the *aculeatus-juncorum* and the *cahirensis-subtilissimus* groups (which together may be said to form a major group characterised by the short tube as compared with the length of the head) have the wing-cilia apparently simple or non-setulose, as also the species of the *niger-leucanthemi* group.

In this memoir I have advisedly used the expression "distinctly setulose," because it would seem that there are different degrees of this condition. I, personally, have not yet examined any species under a greater power than a one-eighth inch objective with a no. 4 Zeiss eyepiece, and under this magnification it would seem that the species of the subgenus *Trybomiella* (of which I have examined *bagnalli* Tryb., *unicolor*, *nigricornis*, and *articulosus* Bagn., *wouramboulchi* Moul., and *melanoceratus* and *robustus* Bagn.) have the wing-cilia indistinctly setulose, the two last-named having wing-cilia—as well as pronotal setæ—of a different type than in the African species. Again, some species appear to have the setulæ not only very minute but adpressed, so that the cilia appear to be ornamented with short dark lines.

Sufficient has been said to indicate that the re-examination of known species, and further research, is required in this direction.

The following new species are described herein :—

- Haplothrips (Trybomiella) dolichothripoides*, sp. n. Sudan.
- (*s. str.*) *sedicola*, sp. n. French Pyrénées.
- *uzelianus*, sp. n. Czecho-Slovakia.
- *microsetosus*, sp. n. Czecho-Slovakia.
- *tenuicornis*, sp. n. S. France.
- *tenuisetosus*, sp. n. Sudan.
- *salinas*, sp. n. S. France.
- *maltbaeki*, sp. n. French Pyrénées.
- *propinquus*, sp. n. French Pyrénées.

- Haplothrips privesnerianus*, sp. n. India.
 --- *phyllireæ*, sp. n. S. France and Spain.
 --- *sorghu*, sp. n. Sudan.
 --- *sorghicola*, sp. n. Sudan.
 --- *quadriceps*, sp. n. French Pyrénées.

I have pleasure in dedicating species to the well-known Thysanopterist Prof. Uzel of Prague, to the Danish Thysanopterist Mr. Maltbaek, who first drew attention to the setulose wing-cilia in *Haplothrips*, and to Dr. Priesner, who has done so much to further the study. I am also much indebted to Mr. W. P. L. Cameron for the few but particularly interesting specimens from the Sudan, odd specimens for the most part from an important collection of Terebrantian thrips submitted some time ago.

Genus HAPLOTHRIPS Serv.

A. Fore wings without duplicated cilia.

Subgenus TRYBOMIELLA Bagn.

Haplothrips (Trybomiella) dolichothripoides, sp. n.

Having the general appearance of a *Dolichothrips*.

♀.—Length about 1.4 mm.; breadth of pterothorax c. 0.2 mm.

Colour blackish brown, abdomen not so dark, fore-tibia distally and fore-tarsi pale yellowish. Wings, excepting basal scale which is brown, transparent; body-bristles pale. Antennæ with joint 1-2 dark blackish-brown, concolorous with head, 3 greyish-yellow, 4 yellowish grey-brown, 5 darker than 4, but not so dark as 6-8, which are of a uniform grey-brown. This species comes near the recently described *talpa* Pr., the only known representative in which the prothorax is scarcely wider than the head—the head being 0.3 or more longer than broad.

Head 1.35 times or thereabouts as long as broad, cheeks subparallel until near base, where they are roundly constricted; eyes dorsally occupying about 0.38 the total length of head; ocelli *not* situated on a prominent hump. Antennæ heavy, joint 4 with sides evenly rounded, almost egg-shaped but for the short basal constriction and the truncate apex, 5 and the following substantially narrower, but difficult to measure accurately in the preparations available.

Pronotum subquadrate, about 0.65 the length of the head, about as broad distally as the head, and only

slightly widened posteriorly where it is about 1.4 times as broad as long; the postero-angular bristles are moderately stout, straight, colourless, and blunt, and c. $50-55\ \mu$ in length, whilst the postoculars and the antero-angular pronotal pair appear to be about 0.5 as long (c. $27\ \mu$ in the type-specimen). The fore wings are c. $770\ \mu$ in length and about $0.65\ \mu$ broad at about the distal sixth; the basal setae are approximately 34, 32, and $80-82\ \mu$ in length, colourless, and are set in the form of a low triangle, the setae 1 and 2, 2 and 3, and (the base) 1 and 3 being separated by 19.5, 16, and $30-33\ \mu$ respectively, 1 and 2 are erect with the ends dilated, whilst 3 is more than twice as long as the others, slightly curved and tapered.

The metanotum has the sides subparallel and is substantially narrower than the mesonotum, thus giving the insect a waisted appearance.

The abdomen has segment 7 narrowed evenly and 8 more sharply distally, whilst 9 is only slightly narrowed from base to apex. The tube is short, stout, and scarcely more than 0.5 the length of the head.

Measurements in microns :—

Length (and breadth) of head and prosternum 210 (155) and 135 (190); dorsal length of eye 80; length (and breadth at base and apex) of tube 112 (57 : 27); median length (and breadth at base and apex) of abdominal tergites 7-9 in the type, 95 (236 : 216), 95 (190 : 124), and c. 82 (c. 105 : 88). Length of longest bristles on 7-9, 70, 67, and $80-82$, and of terminal hairs c. 110.

Antennal joint 3 asymmetrical, subconical, with 2 sense-cones (thus differing from *talpa*, which has but a single sense-cone); relative lengths of joints 3-8 :—

48.5 (27), 51 (30.5), 48.5 (24.5), 43 (21.5), 41 (19),
and 24 (11) μ .

♂.—Smaller and more slender; abdominal segments 9-10 as dark as the head and thorax. Length (and breadth) of head 175 (135) and length (and breadth at base and apex) of tube 94 (43 : 25.5) μ .

This is a smaller species than *talpa* and differs in most points of detail, as will be seen from a perusal of Priesner's description of that species (1931, Bull. Soc. Roy. Ent. d'Egypte, 1930, p. 243).

SUDAN, Wad Medani, both sexes on seedling cotton (Sakel), 17. ii. 32 (W. P. L. Cameron).

B. Fore wings with duplicated cilia.

Subgenus HAPLOTHRIPS, s. str.

AA. Postocular bristles well-developed.

1. Tube as long as or only slightly shorter than the head.

This group includes the following European species: *Haplothrips simplex* (Buffa), *græcus* Ky., and *murru-bicola* Bagn.

2. Tube 0.15 to 0.32 shorter than the head.

a. Wing cilia distinctly setulose, pronotal bristles pointed.

aa. Head as long as, or longer than, broad.

Haplothrips plumociliatus Maltbaek.

1931. Soc. Scient. Fenn., Comm. Biol. 3, xvi. p. 3, figs. 1-3.

I have not yet seen this species, the first in which attention was drawn to the setulose wing-cilia. It differs from the four following species in the details of measurements. Unfortunately, Maltbaek was unable to make any comparative remarks, as he was unaware that a number of known species also possessed setulose wing-setæ—this character having been overlooked. The bristles of the ninth abdominal segment are only 0.57 the length of the tube (80 μ).

Haplothrips dianthinus Pr.

FRANCE, Montlouis and Ax-les-Thermes in the Eastern Pyrénées, ♀♀ and larvæ in the flowers of *Dianthus carthusianorum*, vii. & viii. 26. Recorded by Priesner from Austria and Hungary.

Haplothrips sedicola, sp. n.

♀.—Length 2.0-2.4 mm., breadth of pterothorax 0.45 mm. Dark blackish-brown, fore tibiæ and tarsi and third antennal joint not so dark. Wings lightly fumate with basal scales brown. Body bristles pale, pointed.

Length (and breadth) of head and pronotum 240 (225) and 165-170 (300-315) and length (and breadth at base and apex) of tube 190 (80:42) μ . Length of postoculars 75-80, of postero-angular pronotal bristles 105 and the longest bristles of abdominal segments 7-9

respectively 135, c. 135 and $105\ \mu$; length of terminal hairs c. $140\ \mu$.

Relative lengths (and breadths) of antennal joints 3-8 approximately 66 (35) : 68 (39) : 62 (32) : 54 (27) : 54 (23) and $40\ (14)\ \mu$.

Wings broad basally and distally, duplicated cilia 5-7 (in one example 9); cilia setulose; basal bristles arranged in almost a straight line, practically equidistant ($38 : 42\ \mu$) and $80 : 88-90$ and $85-90\ \mu$ in length respectively.

♂.—Both gynacoid and oedymorous forms present; one example with both antennæ truly 7-jointed.

Separated from *dianthinus* Pr. (and *ebneri* Pr. which probably also falls into this section) by the shorter bristles of the 9th abdominal segment (which in those species are about as long as the tube) and by the fewer duplicated wing-cilia (12-14 in *dianthinus* and 8-9 in *ebneri*). *H. dianthinus* has the wing-cilia distinctly setulose and (as recorded above) falls in this section; *ebneri* I have not seen.

FRANCE, Ax-les-Thermes and Orlu in flowers of a white *Sedum*; l'Hospitalet on *Sedum* sp.; L. Bouillouse on *Sedum villosum* and *Sempervivum* sp., both sexes, viii. 26.

Haplothrips uzelianus, sp. n.

Length c. 2.0 mm., breadth of pterothorax c. 0.41 mm.

Colour and form as in *sedicola* m.

Length (and breadth) of head and pronotum 220 (225) and $150\ (315)\ \mu$ respectively; length (and breadth at base and apex) of the tube $160\ (63 : 36)\ \mu$; length of postoculars 55-60, of postero-angular pronotal bristles 60-65 and the longest bristles on abdominal segments 7-9 respectively $105, 96,$ and $90\ \mu$; length of terminal hairs c. $120\ \mu$.

Relative lengths (and breadths) of antennal joints 3-8 approximately 57 (30) : 58 (37-38) : 52 (32) : 48 (27) : 48 (22.5) and $35\ (12)\ \mu$.

Wings as in *sedicola* m., duplicated cilia 6-9; cilia setulose; basal bristles with 2 on a slightly lower plane than 1 and 3, equidistant ($34 : 34\ \mu$) and 55, 60, and $60\ \mu$ in length respectively.

♂.—A single gynæcoid example differs from the ♀ in being smaller and more slender, and in having the antennal joints longer in relation to their breadths.

This species comes very near to *sedicola* m., from which it differs in its comparatively shorter head and tube and the substantially shorter postocular, pronotal, wing and abdominal bristles.

CZECHO-SLOVAKIA, Vsetin, 2 ♀♀ and 1 ♂ by general collecting, ix. 29.

Haplothrips microsetosus, sp. n.

♀.—Size, colour, and form much as in *uzelianus* m. Third antennal joint yellowish and 4 not so dark as 5-8; wing-scales pale distally and yellowish-brown basally.

Length (and breadth) of head and pronotum 210 (210) and 150 (315) μ respectively; length (and breadth at base and apex) of tube 165 (60 : 34) μ . Postoculars and pronotal bristles not perceptible in the unique example (perhaps vestigial). Lateral abdominal bristles exceptionally small and weak, the longest on abdominal segments 7-9 being 70, 70, and 75 respectively; length of terminal hairs not measurable.

Relative lengths (and breadths) of antennal joints 3-8 approximately 60 (29) : 63 (35) : 55 (29) : 50 (24) : 50 (21) : 36 (14) μ .

Wings as in *uzelianus*, duplicated cilia 6-7, cilia setulose; basal setæ pale, disposition much as in *sedicola* and *uzelianus*, but separated by 36 and 27 μ respectively, their length being ? 24, c. 40, and 45 μ .

This species comes very near *uzelianus*, but differs in the minute body-bristles and other details of chaetotaxy. The intermediate antennal joints are more slender in relation to the length and 4 is not so obviously stout, being 1.44 times as long as broad compared with nearly 1.6 times in *uzelianus*.

CZECHO-SLOVAKIA, Vsetin, 1 ♀ by general collecting, ix. 29.

Haplothrips tenuicornis, sp. n.

♂.—Length c. 1.8 mm., breadth of pterothorax 0.445 mm.

Colour brown, fore-tibia distally and fore-tarsus yellowish;
Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 23

antenna brown, joints 1 and 2 darker than the following joints and 3 paler. Wings clear, basal scales brown.

Length (and breadth) of head and pronotum 205 (186) and ? 135 (270) μ ; length (and breadth at base and apex) of tube 156 (? 65 : 39).

Bristles of head and pronotum dark, pointed, length of postoculars, coxal and postero-angular pronotal bristles respectively 60, 45, and 75 μ ; antero-angular pronotal pair vestigial. Basal wing-bristles paler, relative lengths c. 50, 50, and ? μ , almost in a line and equidistant, being separated by c. 25 μ ; fore-wings markedly constricted medianly and broad basally and distally; duplicated cilia 3-5; cilia distinctly setulose.

Abdominal bristles pale, the longest on segments 7-9 respectively c. 96, 75, and 120 μ ; terminal hairs fine, pale distally, and about 150 μ in length.

Antennæ long and slender, relative lengths of the joints 3-8 approximately 62 (27) : 60 (30) : 59 (27) : 53 (24) : 50 (21) and 34 μ ; joint 3 obconical, practically symmetrical, and furnished with two sense-cones.

This species, although it does not fall in the same section, can only be likened to *angusticornis* Pr., from which it differs in the possession of prominent postoculars (60 as compared with 20 μ) and long postero-angular bristles (vestigial in *angusticornis*), and the distinctly setulose wing-cilia. Priesner has recently described a species from Sinai—*H. bodenheimeri*—that is closely allied to *angusticornis*, belonging to the same section and in which the postero-angular pronotal bristles are 56-65 μ in length and the tube shorter than in *tenuicornis*. In both *angusticornis* and *bodenheimeri* the longest bristle of the ninth abdominal segment is much shorter than in *tenuicornis*, being 85 and 80 μ in length respectively, as compared with 120 μ in *tenuicornis*.

S. FRANCE, Canet Plage near Perpignan, viii. 26, 1 ♂ in flower of *Lotus* sp. with several *H. niger*.

bb. Head markedly broader than long.

Haplothrips tenuisetosus, sp. n.

♀.—This species is the same size, general form, and colour as *odontospermi*, and a detailed description is unnecessary. Apart from the details of differences

shown in these notes and the comparative measurements given under the next species (*H. satanas*, sp. n.), it is most readily differentiated by the narrower wings, the fore-wings measuring across the distal sixth or thereabouts 80–82 as compared with c. 105 μ in *odontospermi*; the number of duplicated cilia is 7–9 in the unique example, and these are separated by 14–16 μ as in *odontospermi*; the cilia are distinctly setulose; the basal scale and bristles are unfortunately not displayed in the single preparation. The eyes are largish, occupying dorsally about 0.44 the total length of the head.

The body-setae are unusually fine and distinctly shorter than in *satanas* or *odontospermi*, the longest on abdominal segment 9 being markedly shorter.

The third antennal joint is yellowish, less heavy than in the allied species, and inclined to be obconical in shape, the outer margin widening in a straight line from above the basal constriction to the angulate distal constriction; the fourth is dark brown, but not quite so dark as the following.

SUDAN, Wad Medani, 7. iv. 32, 1 ♀ from flower of *Dolichos lablab* L. (A. P. G. Michelmas).

Haplothrips satanas, sp. n.

This species would seem to come close to the recently described African species, *odontospermi* Pr., but differs in the transverse head, in the possession of slightly tinged wings and body-bristles (which are fine and pointed as in *odontospermi*), in the disposition of the basal wing-bristles, the fewer duplicated cilia of the fore-wing, the shorter tube, and the shorter and stouter intermediate antennal joints. The pronotum of the unique example is deformed. Fore-tarsal tooth minute.

♂.—Length 1.7 mm., breadth of pterothorax 0.415 mm.

Colour black, fore tibiae and tarsi yellowish; third antennal joint almost concolorous with the following. Wings not truly hyaline, having the faintest greyish-yellow tinge; body-bristles, including postoculars etc., also tinged grey to grey-brown, not clear as in *odontospermi*; basal wing-scales grey-brown with lighter patch at each side.

The following are comparative measurements in microns :—

	<i>satanas</i> , sp. n.	<i>odontospermi</i> Pr.	<i>tenuisetosus</i> , sp. n.
Length (and breadth) of head	225 (240)	208-225 (208-225)	208 (222)
Length (and breadth at base and apex) of tube.	168 (72 : 38)	182 (67-69 : 36)	143 (58 : 33)
Length of bristles :—			
Postoculars	67	78 or more	62
Antero- and postero-angular pronotal	36 : c. 70	c. 40 : 78	? : 60
Longest on abdominal segment 9	145-150	149-155	108-110
Terminal hairs	150	155	c. 125

Relative lengths (and breadths) of antennal joints 3-8 approximately as follows :—

<i>H. satanas</i> , sp. n.	60 (35) : 62 (38) : 57 (32) : 48 (27) : 46 (24) : 36 (15) μ .
<i>H. odontospermi</i> Pr. ..	67 (33) : 64-67 (34) : 59-60 (28) : 53-55 (28) : 48-50 (22) : 36 (14) μ .
<i>H. tenuisetosus</i> , sp. n. . .	51 (29) : 54 (31) : 46 (26) : 43 (24) : 40 (20) : 29 (13) μ .

Fore-wing strongly narrowed medianly and broad basally and distally ; duplicated cilia 7-8 ; cilia distinctly setulose. Basal setæ in the form of a narrow unequal-sided triangle, bristle 1 forming the apex, 2 and 3 the base, and 1 and 2 the shorter of the sides, the distances being 1-2 c. 27 μ , 1-3 c. 34 μ , and 2-3 c. 15 μ ; the length of the bristles (which are pointed and of a dirty greyish-yellow colour) being c. 45, 60, and 75 μ (as compared with 64, 73, and 84-90 μ in *odontospermi*). In *biformis* Moulton these bristles are broadly triangular in disposition, and in *odontospermi* they form a short triangle.

Separated at once from *biformis* by the broad head and the shorter tube, which measure 225 (240) and 168 (72 : 38) respectively, as compared with 230 (200) and 220 (78 : 45) μ in *biformis*, and from *odontospermi* by the characters outlined above. Both *H. biformis* and *odontospermi* have the cilia of the wings minutely setulose ; but the former is a long-headed long-tubed species, more properly classified near *simplex*. Of European species *H. reichardti* Pr. would appear to come near, but apparently differs in the characteristically formed antennal joints

3 and 4 and in the large number (9-13) of duplicated wing-cilia.

S. FRANCE, Perpignan, viii. 26, 1 ♀ in a flower-head of *Centaurea solstitialis*.

The following species agrees with *tenuisetosus* and *satanas* in having a transverse head and setulose wing-setæ, but the intermediate antennal joints are otherwise coloured :—

Haplothrips alexandrinus Pr.

A number of examples from the South of France, including both sexes and larvæ, would seem to be referable to the above recently described species.

Unfortunately, but a single female example was known to Priesner when he described the species, but as he has since met with further examples I hope shortly to have the opportunity of making a comparison.

Whilst the examples recorded below vary considerably in size, in the coloration of the antennæ, and in the number of the duplicated ciliæ of the fore-wing (viz., 5-9), Priesner agrees that they are all referable to one species.

The wing-cilia are distinctly setulose as in *H. satanas* etc.

S. FRANCE, in the heads of Compositæ; Perpignan, viii. 26, both sexes and larvæ on *Centaurea solstitialis*, viii. 26; Canet Plage near Perpignan, both sexes in numbers on *Cineraria*, and 1 ♀ on a daisy; Tamaris near Toulon, iii. 27, 2 ♀♀ and larvæ on a Carline Thistle, and Col de Puymérons, 1 ♀ on *Chrysanthemum alpinum*, vii. 26, c. 6000 feet.

b. *Wing-cilia simple (not setulose) or apparently so.*

Haplothrips statices (Hal.) Bagn.

FRANCE, Wimereux on *Armeria maritima*, both sexes and larvæ, vii. 25; l'Hospitalet and Merens in the Eastern Pyrénées at c. 6000 feet, ♀♀ only on *Armeria cantabrica*, viii. 26, and ITALY, near the Pass di Pordei at c. 7000 feet, ♀♀ only on *Armeria* sp., ix. 29. Hitherto regarded as a purely littoral species.

Haplothrips setiger Pr.

FRANCE, l'Hospitalet in the Eastern Pyrénées, ♀♀ only in flowers of *Sedum* sp. with *H. sedicola*, sp. n., at

c. 6000 feet, viii. 26. Recorded by Priesner from Germany, Austria, Hungary, and Roumania.

Haplothrips vuilleti Pr.

FRANCE, Montlouis, in the Eastern Pyrénées at c. 5000 feet, 1 ♀ in a flower of *Cistus* sp., viii. 26. Described by Priesner from Austria and Hungary.

Haplothrips alpestris Pr.

FRANCE, l'Hospitalet in the Eastern Pyrénées at c. 6000 feet, 3 ♀♀ in the flowers of *Hieracium* sp., viii. 26. Apparently widely distributed.

Haplothrips senecionis Bagn.

Haplothrips distinguendus Bagnall (nec Uzel), 1924, Ent. Mo. Mag' ix. p. 274.

Haplothrips senecionis Bagnall, 1932, l. c. lxviii. p. 164.

FRANCE, Wimereux, vii. 25, and St. Cecil Plage and Etaples, common in all stages in the flower-heads of *Senecio jacobea*. The species is common and widely distributed in the British Isles.

Haplothrips maltbaeki, sp. n.

This species closely resembles *satanas*, but differs in having the wing-cilia simple and not setulose, in the disposition of the basal wing-bristles and in the shorter bristles of the 9th abdominal segment.

♀.—Length 1.6 to 1.8 mm., breadth of pterothorax 0.37 mm.

Colour as in *satanas* m., third antennal joint but slightly lighter brown than the others. Postocular, pronotal, and basal wing-bristles blunt at tips, pale.

The wings are entirely clear excepting basal scales; the basal bristles of the fore-wing are set almost in a line, two being on a slightly lower plane and separated by 36 and 30 μ , their lengths being c. 46–50, 58–60 and 68 μ respectively; duplicated cilia 7–9 (but rarely 7); cilia simple, not setulose. Tube comparatively short, about 0.75 the length of the head.

The following are comparative measurements in microns in respect to both sexes and to a somewhat similar species described hereafter :—

	<i>malibaciki</i> , sp. n.		<i>propinquus</i> , sp. n.
	♀.	♂.	♂.
Length (and breadth)			
of head	200 (210)	200 215 (190-195)	200 (195)
of pronotum	138 (285)	c. 180 (345)	128 (255)
of tube	150 (63 : 39)	160 (66 : 38)	170 (70 : 35)
Length of bristles : --			
Postoculars	60	64	28
Antero- and postero-angular			
pronotal	32 : 75	28 : 60	† c. 15 : c. 45
Longest on abdominal seg-			
ment 9	c. 90	c. 125-132	c. 105
Terminal hairs	c. 130	c. 145	c. 110

The third antennal joint is constricted at base and has the outer margin straight before it is angularly constricted near the distal fourth, whilst the inner margin is rounded. The relative lengths (and breadths) of the antennal joints 3-8 are approximately as follow :—

malibaeki, ♀.... 52 (32) : 56 (36) : 48 (31) : 44 (27) :
42 (22.5) : 33 (14) μ .

♂.... 54 (30) : 58 (34) : 54 (30) : 51 (25) :
48 (21) : 32 (14) μ.

propinquus, ♂.. 61 (31) : 60 (35) : 54 (30) : 48 (25) :
48 (22) : 30 (13) μ .

♂.—Elymerous; somewhat smaller and narrower, having the head comparatively longer, the pronotum large and the fore-legs strongly incrassate, with the fore-tibiae stout and the fore-tarsus armed with a stout tooth. Antennal joints longer and more slender. Special spines of abdominal segment 9 small, sharp and slender (c. 30 μ in length), pale; bristles longer than in the ♀.

FRANCE, Montlouis, in the Eastern Pyrénées at c. 5000 feet, both sexes in flowers of *Cistus* sp., vii. 26.

Haplothrips propinquus, sp. n.

This species very closely resembles *H. malibaski* (though it really belongs to the *leucanthemi* section), and is described from a single gynaeoid ♂, the fore-legs being much as in the ♀ and the fore-tarsus armed with a minute tooth.

♂.—Length c. 1.5–1.6 mm., breadth of pterothorax 0.34 mm.

Taking the differences between the oedymorous and gynæcoid forms into consideration, the following points of difference may be noted. The tube is longer (being 0.85 the length of the head), whilst the bristles of the 9th abdominal segment are relatively shorter. The spines of the 9th abdominal segment are approximately the same length as in ♂ *maltbaeki*, but dark and apparently stouter, whilst the terminal hairs are but 0.65 the length of the tube as compared with 0.80 in *maltbaeki*. The third antennal joint is more symmetrical in form, being of the *leucanthemi* group type, and is yellowish in its basal half, shading to brown distally; furthermore, it is as long as (61 : 60) instead of shorter than the fourth joint and approximately twice as long as broad.

Fore-wing with ten duplicated cilia.

FRANCE, Eastern Pyrénées, l'Hospitalet at c. 6000 feet, 1 ♂ in a flower of *Dianthus fimbriatus*, viii. 26.

3. Tube 0.35 to 0.45 shorter than the head ; wing-cilia simple.

a. Fore-tarsus in female armed with a small tooth
(as in all preceding species).

Haplothrips juncorum Bagn.

This species is evidently widely distributed in England and France, and is found on *Juncus* and on *Scirpus maritima*. An allied species, *H. juncicola* Bagn., has recently been described from England.

FRANCE, Versailles, vii. 26 ; Arcachon, in numbers by sweeping *Juncus* at the mouth of the Teste, viii. 26 ; the Plage d'Hyères, les Pesquiers, and l'Almanarre, common on *Juncus*, ii. & ix. 27 ; St. Cyr-sur-Mer, ix. 27.

Haplothrips acanthoscelis Karny.

FRANCE, Plage d'Hyères, both sexes in dried flowers of *Crucianella maritima*, and ♀♀ of a variety with the intermediate antennal joints yellow in flowers of *Euphorbia paralias*, ix. 27.

ITALY, Bolzano district, at c. 3000 feet, both sexes and the distinctive larvæ in flowers of *Silene* sp., ix. 29.

Haplothrips aculeatus (Fabr.)

Haplothrips cephalotes Bagnall, 1913, Ent. Mo. Mag. lxxiv. p. 266.

I have made some further preparations of my original *H. cephalotes* material, and have come to the conclusion

that the peculiar form of head was due to distortion in mounting and that the species should be referred to *aculeatus*. Of the *aculeatus* section—recognized by the strongly asymmetrical third antennal joint carrying but a single sense-cone—*aculeatus* alone has the cephalic and pronotal bristles pointed.

JAPAN, both sexes on grass, Ashiya, 5. vii. 16, Reg. 295, and 1 ♀, Kobe, iv. 14, Reg. 147 (*J. E. G. Lewis*).

Haplothrips ganglbaueri Pr.

INDIA, examples of both sexes, Puri, Orissa Coast on window pane (Indian Mus. No. 4299/20), Reg. 158.

Haplothrips priesnerianus, sp. n.

This species belongs to the *aculeatus* group and to the second section wherein the cephalic and pronotal bristles are "knobbed." Of the known species *schultzei* Pr. (S. Africa) has these bristles dark; in *froggatti* Hood (Australia), *ganglbaueri* Pr. (Ceylon and India), *eragrostidis* Pr. (Egypt), and this species they are pale or colourless.

H. froggatti is at once distinguished by having 10 duplicated cilia in the fore-wing, whilst both *ganglbaueri* and *eragrostidis* have 4–6 (usually 5) as compared with 6–7 in *priesnerianus*. From *froggatti* this species is further distinguished by its shorter tube—unfortunately, Hood does not give the measurements of the bristles in *froggatti*, but he describes the basal bristles of the fore-wing as being equidistant and the region of the basal scale brown in colour. From *ganglbaueri* the new species is further distinguished by its larger form; the dimensions of the head and tube; the (apparently) shorter terminal hairs; the stouter antennæ, and more especially the stouter 3rd joint—40 (27) compared with 41 (22)—which is only about 1.5 times as long as broad compared with 1.86 times in *ganglbaueri*; and the substantially longer fourth joint. From *eragrostidis* it differs in its broader head, the coloration of its longer and stouter antenna, the shorter postocular, postero-angular pronotal, and basal wing-bristles and the shorter 9th abdominal bristles, which are 90 as compared with 106–112 μ long.

♀.—Length 1.6 mm.

Length (and breadth) of head and pronotum respectively 180 (180) and 130 (c. 300) μ ; length (and breadth at

base and apex) of tube 106 (54 : 31) μ ; length of post-oculars and antero- and postero-angular pronotal bristles 36-38, 36, and 48 μ respectively; of the longest abdominal bristles on 7-9 respectively 95, 85-90, and 90 μ , and of the terminal hairs ? (c. 120 μ in the ♂).

Form and colour much as in *aculeatus*, fore tibia and tarsus pale yellow, the tibia shaded with brown basally and along the outer margin; hind and intermediate tibiae scarcely noticeably pale yellowish at their extreme apices, and tarsi yellow. Bristles colourless. Wings clear, basal scales only very lightly tinted; duplicated cilia 6-7; basal bristles colourless, 1 and 2 more widely separated than 2-3 (28 : 18 μ) and 2 on a higher plane than 1 and 3; 1 and 2 shorter, stouter, erect, and dilated apically; 3 more slender, curved, and almost pointed, their respective lengths being 30, 32, and ? c. 60-70 μ .

Antenna with joints 1 and 2 concolorous with head and 7-8 dark grey-brown; 6 not quite so dark as 7; 3 yellowish, 4 a shade darker, and 5 intermediate between 4 and 6. The relative lengths (and breadths) in microns of antennal joints 3-8 as compared with allied species are approximately as follow:—

<i>H. priesnerianus</i>	..	40 (27) : 48 (31) : 43 (27) : 39 (24) : 36 (20) : 25 (13).
<i>H. eragrostidis</i>	....	34 (22) : 42 (27) : 39 (25) : 38 (21) : 35 (18) : 25 (12).
<i>H. ganglbaueri</i>	....	41 (22) : 43 (28) : 41 (24) : 38 (22) : 34 (19) : 26 (13).
<i>H. froggatti</i>	.....	39 (26) : 48 (31) : 42 (27) : 40 (24) : 37 (19) : 25 (12).

Fore-tarsus with a minute tooth.

♂.—Smaller and more slender; fore-legs slightly swollen, tarsal tooth larger; antennal joint 3 c. 42 (24) μ in length as compared with 38 (24) μ in *froggatti*; spines of abdominal segment 9 about 30 μ in length. Measurements of head and tube 180 (171) and 92 (54 : 30) μ ; length of longest bristle on segment 9 and of terminal hairs (?) and c. 120 μ respectively.

INDIA, Allahabad, in flowers of *Lantana* in jungle, 26. ii. 10, Reg. 209 (*A. D. Imms*).

b. Fore-tarsus in female unarmed.

Haplothrips longipes Bagn.

This species falls in the *subtilissimus* group.

Haplothrips pineticola Bagn.

This species differs from the preceding and all the following in the tapering and apparently pointed bristles of the pronotum and fore-wing basal scales.

Larva.—Whilst of the same type as that of *H. subtilissimus*, the second-stage larva of this species differs as regards the dispersion of the crimson hypodermal pigmentation, in that the head and prothorax are free from same, whilst the abdominal segments 9–10 are not so strongly pigmented. The 9th abdominal segment is comparatively broader, being c. 90 long by 120 and 90 μ broad basally and distally respectively, whilst the 10th is 95 long by 70 and 30 μ broad basally and distally. The bristles 1–3 of segment 9 are as in *H. subtilissimus* and about 100 μ long, whilst the 4th pair are hair-like and c. 150–165 μ in length. The terminal hairs are even longer than in *subtilissimus*, attaining c. 400 (as compared with 280 μ) in length. The length (and breadth) of the antennal joints 3–7 are approximately 66 (26), 63 (27), 50 (24), 35 (20), and 38 (9) μ .

Haplothrips subtilissimus (Hal.).

Larva.—The second-stage larva of this species has the head, prothorax, metathorax, and the abdominal segments 3, 4, and 7–10 with brilliant carmine hypodermal pigmentation and is therefore readily recognized in the field.

FRANCE, on *Quercus robur* at Versailles, Fontainebleau, and Ax-les-Thermes; on *Quercus suber*, *ilex*, and *coccifera* on the Riveira. ITALY, on *Quercus ilex*, ii. 17 (*C. Minozzi*), and on *Ulmus suber* at Collalbo near Bolzano at c. 4000 feet, both sexes, ix. 29.

Haplothrips phylliræ, sp. n.

A form which I originally found on *Phyllirea* agrees very closely with *subtilissimus*, but differs in that the intermediate and hind tibiae are sharply yellow in their

apical fourth and fifth respectively, and are of a brighter and clearer yellow than I have seen in *subtilissimus*, whilst the head is broader and the antennal joints 3-5 are both longer and stouter than in *subtilissimus*. The examination of further material, especially long series from the different trees, is desirable.

The head is as broad as, or broader than, long, whilst the tube is only 0.55 to 0.58 the length of the head. The measurements in microns of two females (one small) and a male (from *Phyllirea*) are as follow :—

	♀♀.	♂.
Length (and breadth) of head....	218 (216) & 200 (210)	200 (200)
Length (and breadth at base and apex) of tube	126 (68 : 39) & 110 (67 : 36)	116 (63 : 33)
Length of :—		
Postoculars	54 & 48	40
Postero-marginal pronotals	80 & 60	50
Bristles on abdominal segments		
8 and 9	100, 105, & 84, 90	66, 110
Terminal hairs	160 & 135	135

The abdominal bristles are strong, dark, and conspicuous.

The fore-wing has 8-10 duplicated, whilst the three basal bristles are much as in *subtilissimus*, but are only 40/45, 40/45, and 64/68 in length as compared with 40/54, 45/60, and 95/110 μ in a number of European examples of *subtilissimus*; they are separated by 30/35 and 18/20 μ respectively.

The relative lengths of the antennal joints 3-8 are approximately as follow :—

♀.. 54 (31) : 63 (37) : 56 (30) : 48 (28) : c. 44 (24) : 25 μ .

♂.. 50 (26) : 57 (32) : 51 (27) : 47 (25) : 42 (20) : 26 μ .

S. FRANCE, Hyères Plage, both sexes on *Phyllirea angustifolium*, ix. 27; Tamaris, both sexes on *Erica arborea*, iii. & viii. 27. SPAIN, Puigcerda, 1 ♀ on *Salix* sp., vii. 26.

Haplothrips floricola Pr.

The hind and intermediate tibiae of this species are unicolorous and not pale apically. The bristles of the basal scale of fore-wing are visible in two of my examples, and are of the same type and disposition as in *subtilissimus*, but pale in colour.

Larva.—The larva would appear to be intermediate between those of *subtilissimus* and *pineticola*, agreeing with the latter in the broad 9th abdominal segment and the very long terminal hairs. The hypodermal pigmentation is present, but weak, in the head, prothorax, and abdominal segments 9 and 10. The abdominal segment 9 is c. 80 long by 112 and 90 μ broad basally and distally, whilst 10 is 80 long by 66 and 27 μ broad basally and distally. Bristles 1-3 of segment 9 are as in *subtilissimus*, and about 75 μ in length, whilst the fourth pair are hair-like and c. 100 μ in length.

The lengths (and breadths) of the antennal joints 3-7 are approximately 48 (22.5), 47 (24), 33 (c. 20), 28 (17), and 27 (9) μ .

FRANCE, Toulouse, 1 ♀ from a public Garden, viii. 26 ; SPAIN, Puigcerda, 1 ♀ on *Pyrus*, vii. 26. SWITZERLAND, Lugano, both sexes and larvæ taken by Mr. J. Johnston Mann chiefly from the flowers of *Verbascum*.

Haplothrips cahirensis Tryb.

This species differs from the following in the longer postocular and pronotal bristles, the postoculars being always longer than 0.5 the length of an eye. The duplicated cilia of the fore-wing number 9-10, whilst the fourth antennal joint is substantially longer than the third—45 (22) : 56 (28) μ . The lengths of the postocular and antero- and postero-angular pronotal setæ in Cameron's examples are 40, 38, and 54 μ respectively.

SUDAN, Darwish, B.N.P., in "dura" field, 1 ♀, and Wad Medani on *Medicago sativa*, 10. ii. 31, 1 ♀ (W. P. L. Cameron).

Haplothrips sorghi, sp. n.

This species very closely approaches *cahirensis*, and has the same type of dark stoutish postocular and pronotal bristles, which, however, are substantially shorter than in *cahirensis*, the postoculars being less than 0.5 the length of an eye. The duplicated cilia of the fore-wing number only 6-7, whilst the fourth antennal joint is not substantially longer than the third.

♀.—Length c. 1.2 mm., breadth of pterothorax 0.25 mm.

Colour dark grey-brown to blackish-brown with the legs, wings, and bristles coloured as in *cahirensis* ; antenna

with joint 3 lemon-yellow, 4 dullish yellow, 5 deeper in colour than 4, 6 light yellow-brown, and 7-8 light grey-brown.

Fore-wings with basal setæ colourless, set in almost a straight line, their lengths 36, 28, and $45\ \mu$ respectively (as compared with 39-45, 42-45, and 56-66 μ in *cahirensis*), the third being slightly curved and not so strongly dilated at tip; they are separated by 27 and 21 μ respectively.

Length (and breadth) of head and pronotum 180 (168) and 105 (220) μ and length (and breadth at base and apex) of tube 96 (54:32). Length of eye c. 68 μ ; of postoculars 28-30 and of postero-angular pronotal setæ 35-40 μ as compared with 40 and 54 respectively in *cahirensis*; the postoculars are only 10 μ distant behind eyes and are finer than the pronotal setæ, which are very stout. Length of abdominal bristles on segments 7-9 c. 75 μ and of terminal hairs c. 120 μ .

The relative lengths (and breadths) of antennal joints 3-8 are approximately 45 (25), 48 (31), 44 (28), 39 (26), 33 (22), and 22 (13) μ .

♂.—Smaller and more slender.

Length (and breadth) of head 180 (180); length (and basal breadth) of tube 95 (52); length of bristles on abdominal segment 9 c. 100-105 μ . Length (and breadth) of antennal joints 3-5 43 (27), 52 (30), and 42 (25) μ . Duplicated cilia of fore-wing 6.

SUDAN, Darwish in "dura" (*Sorghum*) field, ix. 31, (W. P. L. Cameron).

Haplothrips sorghicola, sp. n.

♀.—This species differs from both *cahirensis* and *sorghi* in its exceptionally slender and colourless post-ocular and pronotal setæ, which, however, are dilated at the tips as in the allied species. It further differs from *sorghi* in its more sparsely ciliated wings, the cilia of the fore-wing near the duplicated cilia (which only number 5) being separated by c. 13.5-15 μ as compared with 9.5 to 10.8 μ in *sorghi*. The basal bristles of the fore-wing are 32, 42, and 52 μ in length separated by 30 and 22 μ respectively, 2 being on a somewhat higher plane than 1 and 3.

Length (and breadth) of head 190 (174); length (and breadth at base and apex) of tube 114 (44, 34) μ .

Length of eyes 80, of postocular, antero- and postero-pronotal setae 48, 35, and 55 μ respectively, the post-oculars being more remote from the eyes than in *sorghii*, viz., 20–22 μ as compared with 10 μ in *sorghii*. Length of abdominal bristles on segments 7 and 9 112 and 120 μ respectively and of terminal hairs c. 150 μ .

Relative lengths of antennal joints 3–8 approximately 46 (28), 52 (32), 54 (26), 44 (25), 42 (22.5), and 31 (15) μ .

SUDAN, Darwish B.N.P., 1 ♀ with *H. sorghii*, ix. 31 (*W. P. L. Cameron*).

BB. *Postocular bristles very short or vestigial (wing-cilia simple, fore-tarsus in female armed with a small tooth. Third antennal joint more or less symmetrical, obconical).*

Haplothrips niger (Osb.)=*trifolii* Pr.

FRANCE, Canet Plage near Perpignan, ♀♀ only, in *Lotus* flowers, viii. 26.

Haplothrips angusticornis Pr.

FRANCE, Orlu and Ax-les-Thermes in the Eastern Pyrénées, both sexes in numbers in the flower-heads of *Achillea millefolium*; l'Hospitalet, 1 ♂ in flower of *Viola cornuta* on the French side of the boundary of the little Republic of Andorra and Montlouis, 1 ♂ in flower of *Cistus* sp., viii. 26. DENMARK, an example from Haderslev collected from *Matricaria* and recorded as *leucanthemi* is referable to this species. NORWAY, Oslo district, common in *Achillea*.

Haplothrips quadraticeps, sp. n.

This species is at once recognized by its large quadrate head.

♀.—Dark blackish-grey; fore-tibiae yellowish distally, fore-tarsus light yellow basally, apical part brown. Antenna with joint 3 yellow suffused with light grey-brown; 4 grey-brown irregularly yellowish or paler at or near base, 5–8 dark blackish-brown. Fore-wings with basal scales brown, suffused with pale grey-brown basally and slightly fumate in the basal half but diminishing distally where the wings are almost clear. Body-bristles pale.

Fore-tarsal tooth small and sharp. Wing-cilia simple, *not* setulose; duplicated cilia 10-12; basal bristles 1 and 2 brownish, straight, blunt, and normally stout, 3 pale, slender, curved, and pointed, 45, 54, and 45 μ respectively and 2 on a slightly lower plane than 1 and 3 and separated by 36 and 45 μ respectively.

Length (and breadth) of head and pronotum 350 (262) and 180 (390) μ respectively; length (and breadth at base and apex) of tube 198 (70 : 46) μ .

Length of bristles on 9th abdominal segment c. 98-105 and of terminal hairs c. 165 μ . Pronotal bristles difficult to discern in the unique example; those at posterior angles about 80 μ in length.

Antenna of normal type with joint 3 more or less obconical in form and furnished with two sense-cones; relative lengths (and breadths) of joints 3-8 approximately 65 (37) : 72 (42) : 67 (36) : 62 (30) : 56 (c. 25), and 42 (c. 15) μ respectively.

Total length 2.3 mm., breadth of *pterothorax* c. 0.5 mm.

FRANCE, L. Bouillouse near Montlouis in the Eastern Pyrénées at c. 7000 feet, 1 ♀ on a flower of *Sempervivum* sp., viii. 26.

Haplothrips propinquus Bagn.

This species is described next to *H. maltbaeki* herein on account of its close general resemblance, as a matter of convenience. Actually it falls in this section, and is the only species having the head transverse. It differs from *niger* in its transverse head and relatively longer tube, in the coloration of the antennæ, and in the relative sizes of the intermediate antennal joints. The bristles of the 9th abdominal segment are appreciably longer than in ♂ *niger*.

XLII.—*The Lechwe of South-Central Africa.*

By EDGAR N. BARCLAY.

THE lechwe material in the British Museum has recently been augmented by two valuable series of skins obtained by Capt. C. R. S. Pitman in the Mpika and Chinsali districts of Northern Rhodesia.

The lechwe of South-Central Africa have hitherto been classified as three distinct species—*Kobus* (*Onotragus*)

leche Gray, *smithemani* Lydekker, and *robertsi* Rothschild. An examination of the whole of the material now available, however, shows that certain of the characteristics on which these species were based are not constant, and therefore valueless. Furthermore, the skins in the Museum exhibit every stage of transition in colour, from the typical fulvous-coloured lechwe to the animal in which the upper parts and fronts of limbs are almost completely blackish brown.

A brief description of the skins examined may be summarized in such order as to show the various stages of transition.

From the table on pp. 336-338 it is to be noted that in six specimens the hair along the middle of the back is directed backwards, and in the remaining twenty-three it is reversed—that is, directed forwards from a point about the centre of the back, towards, and sometimes including, the nape of the neck. In some cases this amounts to little more than the reversal of a single wisp of hair, and in others it extends for as much as 31 inches. Lydekker regarded this reversal of the hair as a characteristic of *smithemani* *, but skin no. 21.7.18.36, which is the darkest in the collection, shows no trace of it; and in six other dark examples, shot by Capt. C. R. S. Pitman in the Mpika district of Northern Rhodesia on 12. v. 1932, three have the hair directed backwards and three have it reversed. The table likewise shows that it is erroneous to regard the hair of the back being directed backwards as a characteristic of *leche*, for of the first four specimens enumerated, all of which are of the wholly fulvous colour assigned to *leche*, two have the hair reversed and two have not.

The ground-colour of the skins in the collection varies from fulvous to chestnut and the general colour from fulvous to blackish brown, caused by the admixture of blackish hairs. It will be noted that there are no "collectors' dates" against the first four specimens tabulated, but it is possible that these pale fulvous skins may have been from animals approaching the period of moulting, and in their new coats they might well have exhibited a brighter and more rufous appearance. So

* Cat. Ung. Mamm. Brit. Mus. vol. ii. p. 249 (1914).

B.M. no.	Sex.	Locality.	Collector's Date.	Description.
50.7.4.2.	..	R. Zonga (=Botletle R.).	....	Hair on middle of back not reversed. Black of fore legs not extending to shoulders. General colour light fulvous.
{ 31.4.20.1. Mounted skin.	♂.	Chobe R.	....	Hair on middle of back reversed for more than half the length of the back. Black of fore legs not extending to shoulders. General colour light fulvous.
99.3.21.2.	♂.	Barotseland.	....	Hair on middle of back not reversed. Black of fore legs not extending to shoulders. General colour fulvous.
99.3.21.1.	♂.	Do.	....	Hair on middle of back reversed over 31". Black of fore legs not extending to shoulders. General colour fulvous.
{ 94.3.8.9. Headless skin.	..	L. Mweru.	....	Hair on middle of back reversed over 31". Black of fore legs not extending to shoulders. More inclined to rufous than previous skin.
13.11.27.1.	♂.	R. Luongo, N.E. Rhodesia. 3500'.	7. x. 1913.	Hair on middle of back reversed over 7". Black of fore legs extending faintly to shoulders. Neck also flecked with black hairs. General colour as in previous skin.
{ 13.11.26.1. Headless skin.	♂.	Luena R., trib. of Kalungwivoi R., N.E. Rhodesia.	....	Hair on middle of back reversed over 17". Distinct black patches on shoulders, but these are isolated from the black fore leg markings. General colour rufous.
{ 14.1.7.11. Headless skin.	♂.	Laongo R., N.E. Rhodesia.	....	Hair on middle of back reversed over 10". Black of fore legs extending faintly on to shoulders. General colour rich rufous.
{ 7.11.15.3. Headless skin.	♂.	Chilorle Flats, Chambezi R., Chin-sali dist., N.E. Rhodesia.	8. i. 1906.	Hair on middle of back reversed over 12". Markings and colour as in previous skin.
{ 7.11.15.2. Headless skin.	♂.	Do.	30. xii. 1905.	Hair on middle of back reversed over 21". Black of fore legs extending faintly to shoulders. Traces of black on flanks. General colour slightly darker rufous.

Collector's no. 1063.	♀.	Kabinda, R. Lukulu, E. of Bangweulu Swamp, Mpika dist., N. Rhodesia, 3800'.	12. v. 1932.	Hair on middle of back not reversed. Black of fore legs extending faintly to shoulders. General colour chestnut.
1064.	♂ juv.	Do.	Do.	Hair on middle of back not reversed. Markings and colour as in previous skin.
1062.	♂.	Do.	Do.	Hair on middle of back not reversed. Black of fore legs extending distinctly to shoulders. General colour chestnut.
1065.	♂ juv.	Do.	Do.	Hair on middle of back reversed over 6". Black of fore legs extending distinctly to shoulders. General colour chestnut.
1067.	♀ juv.	Do.	Do.	Hair on middle of back reversed over 8". Markings and colour as in previous skin.
1066.	♀ juv.	Do.	Do.	Hair on middle of back reversed over 3". Black of fore legs extending distinctly to shoulders. Throat tinged with black. General colour chestnut.
B.M. no. 7.11.28.1. { Headless skin.	....	Luababa dist., Congo.	....	Hair on middle of back reversed over 15". Well-defined black markings on shoulders. Flanks well sprinkled with black hairs. General colour chestnut.
Collector's no. 1119.	♂ juv.	Mulenga, Bwela Flats, R. Chambezi, Chinsali dist., N. Rhodesia, 4500'.	14. viii. 1932.	Hair on middle of back reversed over 12". Faint black markings on shoulders and cheeks. General colour slightly darker chestnut than in previous skin.
B.M. no. 27.8.16.10. Collector's no. 1118.	♀.	Chapa, Luapula R.	....	Hair on middle of back reversed over 6". Markings and colour as in previous skin.
	♀.	Mulenga, Bwela Flats, R. Chambezi, Chinsali dist., N. Rhodesia, 4500'.	14. viii. 1932.	Hair on middle of back reversed over 11". Faint black markings on shoulders. Distinct black markings on cheeks. General colour as in previous skin.

Collector's no.	Sex.	Locality.	Collector's Date.	Description.
1117.	♂.	Mulenge, Bwelo Flats, R. Chamberi, Chinese distr., N. Rhodesia, 4500'.	14. viii. 1932.	Hair on middle of back reversed over 15". Well-defined black markings on shoulders. Faint markings on cheeks. General colour as in previous skin.
1120.	♂.	Do.	Do.	Hair on middle of back reversed over 11". Well-defined black markings on shoulders, throat, and cheeks. General colour dark chestnut.
1121.	♂.	Do.	Do.	Hair on middle of back reversed over 25". Markings and colour as in previous skin.
B.M. no. 16.7.16.2.	Bangweolo Flats.	....	Hair on middle of back reversed over 14". Well-defined black markings on shoulders, throat, cheeks, and flanks. General colour slightly darker than in previous skin.
{ 7.11.15.1. Headless skin.	♂.	Chilorio Flats, Chamberi R., N.E. Rhodesia.	30. xii. 1905.	Hair on middle of back reversed over 11". Well-defined black markings on shoulders and throat. Flanks blacker than in previous skin and back tinged with black.
12.12.21.1.	♂.	Mukamba R., N. Rhodesia, 3900'.	....	Hair on middle of back reversed over 13". Well-defined black markings on shoulders, neck, and cheeks. Back more noticeably sprinkled with black than in previous skin.
{ 7.11.15.4. Headless skin.	♂.	Chilorio Flats.	30. xi. 1905.	Hair on middle of back reversed over 20". Well-defined black markings on shoulders and neck. Colour of back as in previous skin.
11.2.23.1.	L. Mweru.	....	Hair on middle of back reversed over 12". Well-defined black markings on shoulders, neck, and cheeks. General colour of upper parts blackish brown.
21.7.18.36.	♂.	Imbo Junction, Luapula R., N. Rhodesia.	....	Hair on middle of back not reversed. Body, throat, and cheek-markings slightly darker than in previous skin, but area above shoulders and nape of neck brown.

many of the skins in the collection are undated, however, that I find it impossible to draw any definite conclusions regarding seasonal change, and this aspect of the subject must perforce be left over until further and correctly dated material comes to hand.

The markings which are said to characterize *robertsi* appear to be no more than the first stages of the transition from the fulvous to the blacker form, and it would be quite impossible to determine whether many of the skins in the Museum should be assigned to *robertsi* or *smithemani*.

Rothschild states that *robertsi* occurs in the same territory as *leche* and *Smithemani* *, and a study of the localities enumerated in the table shows that no particular area produces animals with coats which are constant in colour and markings; from these facts therefore it would appear that colour has no specific value in relation to *smithemani* and *robertsi*.

Lechwe are not so well represented in the Museum by skulls as by skins, but an examination of the material available reveals no structural differences. The horns (perhaps the least valuable factor in specific determination) of the three supposed species are said to exhibit slight differences, but from an examination of the examples in the collection I have been unable to detect any differences that would not be attributable to slight individual variations.

The conclusion drawn from this survey is that there is only one species of lechwe in South-Central Africa, but that owing to its marked tendency to melanism its colour may vary from fulvous to blackish brown. On this assumption I take the names *smithemani* and *robertsi* to be synonyms of *Kobus* (*Onotragus*) *leche*.

XLIII.—*The Genus Cœlopa* Meigen (Diptera, Cœlopidae).

By JOHN R. MALLOCH.

SOME three or four years ago I started work on the members of this genus in connection with a series of papers dealing with the New Zealand Acalyptrate Diptera, and prepared a manuscript, which, unfortunately, it will be impossible to publish for an indeterminate length of time. I am now presenting in this short paper the main points

* Proc. Zool. Soc. 1907, p. 237.

brought out in that work, in the hope that the data will be useful to students of the family.

Considerable confusion has existed in the interpretation of the genus ever since its erection in 1830, the last attempt to clear up the situation having been made by Aldrich in 1929*. Unfortunately that writer accepted Stenhammer's suggestion that *frigida* Fabricius was a *Scatophaga*, and he identified as *gravis* Haliday a species which he afterwards, from an examination of the Fabrician type, discovered to be the true *frigida*—a fact published by Haliday many years ago. No attempt was made to subdivide the genus, and all four North American species were retained in *Caelopa*.

In defining the family Aldrich accepted as criteria a summary of the characters used by Hendel in his key to the families of Diptera published in 1928†. This summary includes the more salient characters given by Hendel, though one might interpret it as indicating that the scutellum has but two instead of four bristles. There are, however, several striking characters that are not listed, such as the haired prosternal plate, the presence of very short setulæ on the posterior lower angle of the hypopleura, the bristling of the pleura, and the structure of the apical tarsal segment and its appendages, all of which are quite important in the determination of members of the family, and particularly of the groups to which species of *Caelopa* in its widest sense belong. All species of *Caelopa* in the wide sense have the first two characters the same‡, and the appendages on the fifth tarsal segment are very much the same throughout, the empodium being slightly widened and furnished with several long hairs in a series extending back from the base that are curled similar to the empodium, and in most cases lie against it forming a fasciculus, while there is a spine of hair at the base of each pulvillus that under certain circumstances may appear as an erect and almost straight spine. The claws are also much curved, frequently flattened, sickle-like, with the bases narrower than the base of the flattened part, and distinctly pilose.

I am confining this group to those species in which the prosternum is well separated from the chitinous propleura

* Proc. U.S. Nat. Mus. lxxvi. (11), pp. 1-6.

† Tierwelt Deutschlands, Jena, part 11, sect. 2, pp. 86-89.

‡ Two species have the prosternum apparently bare (*Catopella* spp.).

by a well-defined sunken membranous strip, and the epistome in side-view projects well beyond the level of the anterior margin of the frons. The prelabrum is well developed and the central part of the epistome is above the level of the vibrissal angles, so that the former is usually withdrawn in the space between the angles though visible from the side. There is considerable variation in the group in the width of the central part of the epistome, but it is not my intention to deal with the species at this time, so I defer going into this feature until my paper on the New Zealand species appears in print.

In the following key I have presented a characterization of the various segregates now known to me, and propose names for those that are apparently entitled to be considered as distinct from *Cœlopa* in the strict sense. I have in making use of the separated prosternal plate and propleura been compelled to reject several genera as coming within this review, these evidently being referable to Phycodrominæ.

Key to the Genera.

- | | |
|--|---|
| 1. Metasternum haired; mesopleura bare . . . | <i>Cœlopa</i> Meigen. |
| Metasternum bare; mesopleura bare or
setulose | 2. |
| 2. Mesopleura bare | 3. |
| Mesopleura with hairs or bristles | 4. |
| 3. Stern-vein of wing with numerous short
black spinules on the under surface which
are most numerous at and close to the
junction with the humeral cross-vein. . . . | <i>Protocœlopa</i> , gen. nov. |
| Stern-vein of wing without hairs or setulæ
below | <i>Cœlopella</i> , gen. nov. |
| 4. Pteropleura with some soft hairs on centre;
hairs on mesopleura dense and fine, one
or two on the hind margin setulose and
longer | <i>Dasyccœlopa</i> , gen. nov. |
| Pteropleura bare; mesopleura with at
least one strong hind marginal and
several much shorter and weaker discal
bristles | 5. |
| 5. At least three pairs of well-differentiated
dorsocentral bristles on the mesonotum. . | 6. |
| Only the posterior pair of dorsocentral
bristles on mesonotum developed. | <i>Cœlopina</i> , gen. nov. |
| 6. All femora and the abdominal tergites and
sternites with long strong macrochètæ;
arista nude | <i>Chastocœlopa</i> , gen. nov. |
| Femora and abdomen lacking macrochètæ;
arista short-haired | <i>Malacomylia</i> Hal.
[(<i>Phycodroma</i> Stanhammer).] |

CÆLOPA Meigen.

Prosternum and metasternum haired; mesopleura bare; scutellum much wider at base than its length in centre, the sides bevelled basally; humeral none or one; first vein sometimes setulose or haired in part.

Genotype, *Cælopa frigida* Meigen, nec Fabricius.

Cælopa frigida Fabricius was the only species included in the genus by Meigen in 1830, but Haliday pointed out that the species so accepted by Meigen was erroneously identified, and he proposed for it the name *pilipes* Haliday. This course has been followed by subsequent authors. *Fucomyia* Haliday was erected in 1830, and three species were placed in it: *frigida* Fabricius (= *gravis* Haliday, 1833), *simplex* Haliday, and *parvula* Haliday. Westwood, in 1840, cited *frigida* Fabricius as the "typical species" or genotype of *Fucomyia*, and as long as the old concept of the genus is retained no difficulty arises from the misidentification by Meigen. Now I propose to recognize three subgenera, including *Cælopa* and *Fucomyia*, and am thus compelled to decide what course to follow in the treatment of the genotype of the former. As this has been by long usage determined as *pilipes* Haliday, following the statement by Haliday I am accepting the course, though there undoubtedly will be some students who will object to this action. I do not intend that the course pursued in the present case shall be accepted as establishing a precedent for my treatment of other similar cases.

The subgenera may be distinguished as below:—

Key to the Subgenera.

- | | |
|--|------------------------------|
| 1. First vein (radius) bare at base below | <i>Fucomyia</i> Haliday. |
| First vein haired at base below | 2. |
| 2. First vein bare above | <i>Cælopa</i> Meigen. |
| First vein with one or two setulae near humeral cross-vein and a series on the apical third or less of the upper surface.. | <i>Neocælopa</i> , gen. nov. |

CÆLOPA Meigen.

In addition to the characters mentioned in the key the genotype, and only species known to me, has a well-developed bristle mesad and a little behind the level of the anterior notopleural, which may represent the presutural bristle, that is lacking in the other subgenera. The epistome in centre is quite narrow, rather pointed,

and produced beyond the level of the vibrissal angles, and the arista is apparently bare, though under a high-power lens there are some very sparse decumbent hairs evident.

Genotype, *Cœlopa pilipes* Haliday.

Seen only from Europe.

FUCOMYIA Haliday.

This subgenus contains a number of species that are readily separated from each other by structural characters, principally of the head, abdomen, and legs. Those available to me are : *frigida* Fabricius, *parvula* Haliday, *stejnegeri* Aldrich, *nebularum* Aldrich, *curvipes* Hutton, and one undescribed species from Africa.

Genotype, *Musca frigida* Fabricius.

The genotype occurs in the Palearctic and Nearctic regions, *parvula* in the first-mentioned region, *stejnegeri* and *nebularum* in the Nearctic region, and *curvipes* in New Zealand.

Cœlopa (Fucomyia) africana, sp. n.

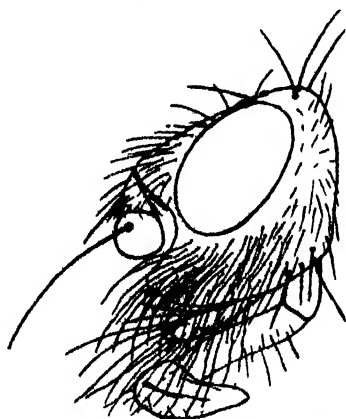
Male and female.—Head fuscous, with grey dust on the occiput, frontal triangle, and orbits, the cheeks, and face; antennæ brownish yellow; genæ showing yellowish under the grey dust; palpi brownish yellow. Frons at postvertical bristles almost flat, its length from there to anterior margin twice as great as its width at upper angles of eyes, the triangle narrow anteriorly, visible to beyond middle, all four vertical bristles strong, practically transverse in position, the postverticals well developed, slightly incurved at tips, surface-hairs long and strong, not very numerous, the inner two series cruciate; ocelli in an equilateral triangle, the posterior pair as far from vertex as width across them; orbits narrow, with three outwardly curved upper bristles, the grey dust anteriorly divided longitudinally in centre; anterior orbital hairs curved mesad, quite dense at insertions of antennæ, and carried downward on parafacials to near level of apex of second antennal segment (see accompanying figure); hairs on genæ and palpi much longer in male than in female; aristæ bare.

Thorax with the dorsal hairs short and stout; the single humeral, both notopleurals, the supra-alar, anterior postalar, posterior pair of dorsocentrals, and acrostichals

well developed; scutellum with four bristles, usually subequal in length.

Abdomen flattened in both sexes, but in the male with the hypopygium thickened, black in female, with apices of tergites testaceous yellow in male, the female with very short hairs except a few longer at apices of apical two tergites, in the male with the first and second tergites short-haired, the third long-haired on sides and at apex, fourth and fifth long-haired on entire surface.

Legs tawny yellow, the femora sometimes blackened centrally, in male with very long but not very dense dark hairs, only the apical one or two segments of tarsi with shorter hairs. Female with much shorter hairs. Fore metatarsus of male with the usual broad thumbnail-like apical ventral process; mid-metatarsus with four



Head of *Ocelopa (Fucomyia) africana*, male, in profile.

or five strong curved black spines along the anterior edge and without an apical process; hind metatarsus with the same anterior armature as mid one, and, in addition, a narrower apical process on venter than the fore metatarsus, which is like a stout horn. Tibiæ of male with the preapical dorsal bristle merely a long fine hair, which is hardly distinguishable except on the fore pair, mid pair with four or five apical spurs and sometimes one shorter preapical ventral spur, hind tibia with two apical spurs. Tarsi of female without apical ventral process

on basal segment. Tibiæ with the preapical dorsal bristle fine on fore pair, much stronger on mid and hind pairs, the two latter also with several ventral bristles on apical half.

Wings yellowish hyaline, veins brownish yellow. First costal division about half as long as second, first vein gradually approaching costa and entering it a little before level of inner cross-vein in the male, above it in the female, the inner cross-vein distinctly beyond middle of discal cell in male, very slightly beyond it in female. Costal vein very fine-haired above from base to apex of subcostal vein and on entire length below, with short closely placed black spinules on upper anterior edge from apex of subcostal vein to a short distance beyond apex of second vein.

Length 5-6.5 mm.

Type, male, allotype, 1 ♂, 1 ♀ paratype, Port Nolloth, Namaqualand, July 1921 (*H. D. Stanton*).

Cœlopa (Fucomyia) curvipes Hutton.

This New Zealand species is the most closely allied to *africana* of those now before me, having the abdomen without any bristles, at least in the male, the legs with long fine hairs, which are, however, much shorter than in the new species, especially on the fore tibiæ and tarsi, the cheeks and palpi much shorter and stronger haired, the aristæ with very distinct pubescence, and the hind metatarsus with no anterior bristles except at apex. Second tergite haired on sides, third on disc.

Invercargill, N.Z., compared with type by Dr. A. L. Tonnoir.

All the other species have distinct bristles on the abdomen and tibiæ in the males.

NEOCŒLOPA, subgen. nov.

This subgenus is readily distinguished by the characters cited in the key.

Subgenotype, *Cœlopa vanduzeei* Cresson.

Extends from San Diego, Calif., on the sea-coast, to Kodiak, Alaska.

PROTOCŒLOPA, gen. nov.

A rather remarkable genus erected for the reception of one New Zealand species which is the largest known

to me, exceeding even *Chaetocaelopa monstrosa* (Hutton) in length. There is a marked sexual difference in the chaetotaxy of the head, thorax, and legs, as will be seen from the description of the genotype below. The characters cited in the key should suffice for the recognition of the genus, though others may be gleaned from the description.

Genotype, the following new species.

Protocaelopa philpotti, sp. n.

Male and female.—Brownish black, only the mesonotum slightly shining, the sutures of the pleura paler, brown. Palpi fuscous. Legs yellowish brown. Wings greyish hyaline, with a yellowish suffusion along the veins, the latter dark brown. Calyptra brown, margin and fringes of lower one fuscous. Halteres brown.

Frons dull black, the orbits and triangle slightly dark grey dusted, width at upper angle of eyes half that of head, length from posterior ocelli to anterior margin about equal to its width at latter point, the surface hairs short and stout in male, longer and finer in female, the male usually with only the ocellar bristles developed, and these very short and strong, the female with usually all four verticals, the ocellars, and two pairs of outwardly curved orbitals moderately long, and the postverticals small or lacking. Eye higher than long, gena not as high as in the preceding new species, the centre of epistome broadly transverse. Arista subnude. Genal hairs strong, in male short stubbly bristles.

Thorax with all the bristles very short and stubbly in male, almost undeveloped, only the apical pair of scutellar bristles long, erect, the sternopleural bristle not developed. Female with the usual bristles well developed, one short humeral, the posterior pair of dorsocentrals fine but distinct, posterior acrostichals minute, the sternopleural much shorter than usual; scutellum with one long apical pair and a very short lateral pair of bristles.

Abdomen flat and rather broad, with very short surface hairs except on the sides of the second tergite, where they are longer, in the male forming a group of rather closely placed bristles of various sizes, longest at the curve.

Legs pale brown, stout, the femora of the male more especially so. Fore femur in male with a clump of four or five bristles at base on anteroventral surface, and apically two series of bristles, one on the anteroventral and the other on the posteroventral surface, that are decumbent, with apices directed towards apex of femur; fore femur of female with no basal clump of bristles, and the others rather shorter and weaker; mid-femur of male with two or three short very strong bristles beyond middle on the anteroventral surface, and some much shorter bristles on the posteroventral surface apically; mid-femur of female with the anterior bristles weaker and higher placed, on anterior surface; hind femur of male with almost the same armature of the anteroventral surface as the mid-pair, but the posteroventral surface has two or more very strong bristles about at the same position as those on the opposite surface; female with similar but weaker armature. Tibiæ of male with the surfaces covered with minute stubbly black spines, and with one, or two distinct anterodorsal bristles on the fore and mid pairs, the preapical bristle present, mid-pair with several short stout bristles or spines before the apex and the usual strong curved apical spurs, hind tibia with the preapical and another bristle on anterodorsal surface closer to apex, much longer than the single curved apical spur; tibiæ of female with more numerous anterodorsal and a few weaker posterodorsal bristles, the only ventral bristles being close to apex of mid- and hind pairs. Fore and hind metatarsi of male with the usual apical nail-like process, mid-metatarsus with anteroventral spines, the hind pair without them. Tarsal claws in both sexes broadly sickle-shaped.

Costal vein in male with stout closely placed short black spinules from base to beyond apex of second vein; beyond apex of first there are two additional series of longer and stouter more widely placed black spines; in female the armature is less strong basally.

Length 8-11 mm.

Type, allotype female, and 13 paratypes, Invercargill, N.Z.

This species name was suggested by Dr. A. L. Tonnoir in honour of the collector, Mr. A. Philpott, who has collected many interesting insects in New Zealand.

CÆLOPELLA, gen. nov.

This genus is erected for the reception of two New Zealand and one Australian species, but only the genotype is described below. It may be that later on, when I obtain more material, the erection of two subgenera may be necessary, but meanwhile I restrict my survey to one species only.

The characters of the genus are much as in *Cælopa*, but the first vein is bare below and the metasternum is also bare.

Genotype, *Cælopella plebeia*, sp. n.

Cælopella plebeia, sp. n.

Male and female.—Very similar in almost every respect to *Cælopa curvipes*, differing in the generic characters as indicated above and as follows:—Arista shorter, not noticeably longer than the eye, while in *curvipes* it is very distinctly longer, distinctly but more closely pubescent; thorax usually with three narrow and inconspicuous brown vittæ, which merge posteriorly, the brown colour covering almost all of the scutellum in the male. Mid-metatarsus of male with a complete series of antero-ventral black spines, while in *curvipes* the spines are confined to the apical half or less of that surface. In other respects similar to *curvipes*, though the hairs on the legs are usually shorter.

Length 3.5–6 mm.

Type, male, allotype, and 13 paratypes, Invercargill, N.Z. Paratypes, Dunedin and Otago, 11 specimens.

The Otago specimens are from the Osten-Sacken collection in the Deutsches Entomologisches Museum, Berlin, submitted for identification by Dr. Walther Horn, and will be returned to that institution. Paratypes will be placed in the British Museum.

DASYCÆLOPA, gen. nov.

This is the only genus known to me in which there are hairs on the pteropleura. The entirely fine-haired mesopleura is another outstanding character. The genotype has two humeral bristles, the upper one directed mesad, the prosternum haired, the presutural bristle short or

lacking, two posterior dorsocentrals, and the male with the usual apical process on fore and hind metatarsi. Wings without hairs on any of the veins, the venation as in the preceding genus.

Genotype, the following species.

Dasycœlopa australis, sp. n.

Male.—Head testaceous yellow, frons more reddish, occiput and ocellar region fuscous, frontal orbits, post-ocular orbits, frontal triangle, genæ, and face with grey dust, the frons with less evident grey dusting. Antennæ, aristæ, and palpi testaceous yellow, third segment of antennæ slightly darkened above at apex; prelabrum fuscous. Frons at upper angle of eyes about half as wide as long from there to anterior margin; ocelli as far removed from vertex as width across posterior pair, the latter farther removed from each other than either is from anterior ocellus, the distance of each from eye about as great as width across posterior pair; ocellar bristles small, rather widely separated, in line with posterior margin of anterior ocellus; vertical bristles short, the outer pair slightly anterior to posterior pair; post-verticals short, slightly below curve of vertex; each orbit with one or two short outwardly curved bristles on upper half; interfrontalia with numerous regularly arranged short setulæ; triangle very short, orbits almost linear. Head much as in *Cœlopa pilipes*, the centre of epistome rather narrow, the prelabrum projecting rather pointedly; genæ finely haired above, the hairs becoming stronger below and anteriorly, at the vibrissal angle bristle-like; aristæ microscopically pubescent, much shorter than eye, the latter distinctly longer than high.

Thorax fuscous, densely grey dusted, with three rather evident dark grey vittæ. Surface hairs regular and setulose, longer and stronger on sides of the scutellum, the latter with four subequal bristles. Pteropleura with some very fine hairs; hind margin of the mesopleura with one fine bristle amongst the hairs; sternopleural not conspicuous.

Abdomen narrow, subcylindrical, coloured as thorax, with fine hairs which are longer on sides of fourth and all of fifth tergite.

Legs testaceous yellow, the femora centrally and tibiæ and tarsi apically slightly darkened. Fore femora thicker than mid- or hind pairs and longer haired than either; mid-tibiæ with long decumbent ventral hairs, hind tibiæ with longer dorsal than ventral hairs; pre-apical dorsal bristle hair-like on all tibiæ; mid-tibiæ with about three strong apical spurs and one preapical ventral spine; hind tibia with one long and one short apical spur; fore and hind metatarsus with the usual apical process; mid one with no process, and like the hind one with a few widely spaced anteroventral bristles. Tarsal claws not appreciably flattened.

Inner cross-vein about two-fifths from apex of discal cell.

Female.—Similar to the male in general characters and coloration, but greasy, so that the mesonotum is not of the natural colour. Differs from the male in the usual manner, the hairs on legs shorter and the bristles on apices of the tibiæ and the base of tarsi better developed.

Length 4.5–5 mm.

Type, male, and allotype, Townsville, Queensland.

CHÆTOCÆLOPA, gen. nov.

Readily distinguished from any but the next genus by the strongly bristled mesopleura, which has at least one strong hind marginal and a number of weaker discal bristles. The mesonotum has at least three pairs of well-developed dorsocentral bristles, while the next genus has but one pair. The posteroventral edge of the fore coxæ is armed with a series of curved bristles which lie close against the pleura and are much stronger in the male than in the female.

Genotype, *Cœlopa monstruosa* Hutton.

In addition to the genotype there are two other species of the genus all from New Zealand, *littoralis* Hutton and one undescribed species.

CÆLOPINA, gen. nov.

This genus is erected for the reception of *Cœlopa anomala* Cole, a species from the Pacific Coast in California.

XLIV.—*Entomological Expedition to Abyssinia, 1926-7.*
Hymenoptera, II.: Sphegidæ and Psammocharidæ.*
By GEORGE ARNOLD, D.Sc. With an Introductory
Note and Supplementary List by HUGH SCOTT, Sc.D.

Introductory Note.

[In the following account of the Sphegidæ and Psammocharidæ collected by Hugh Scott and J. Omer-Cooper in the highlands of central Abyssinia Dr. Arnold is responsible for the description of all the new species. He has also determined many of those previously known, but some (as mentioned below in each case) were determined by Mr. R. E. Turner.

Five new species are based on material collected by the Expedition, but three others† are included, although based solely on material obtained by earlier collectors.

Localities and other data are given in full, and under every species of which the British Museum already possessed specimens from Abyssinia the data attached to those specimens are included.

At the end of the paper a list is added of species recorded from Abyssinia, of which no specimens were obtained by the Expedition of 1926-7.

SPHEGIDÆ.—The Expedition obtained specimens of fourteen species, two of which are new. These two, with a third new species described from material collected by Kovacs, are unknown outside Abyssinia. The others are almost all characteristic of the Ethiopian Region, in which they are more or less widely distributed; one of the new species also seems to be closely related to South African forms. One well-known species, *Sceliphron spirifex*, occurs not only over the whole Ethiopian Region, but also round the Mediterranean and in Arabia. The only specimens taken near the coast at Jibuti (French Somaliland) might have been expected to show Southern Palearctic affinities, but Mr. Turner referred them to an Ethiopian species (*Arpactus monstrosus*).

PSAMMOCHARIDÆ.—Eight species are represented in the material collected. Two are new to science, and

* Hymenoptera, I. (Apidae, exclusive of *Andrena* and *Halictus*), appeared in Trans. Ent. Soc. lxxx. pp. 47-55, 1932.

† *Stizus bidens*, *Pseudagenia kovaci*, and *P. hirticeps*.

two other new species, of which no examples were taken by the Expedition, are included. These four new species and one previously known form are recorded only from Abyssinia. Three of the remaining species are widely distributed in Eastern and Southern Africa, and one ranges over the whole of Africa, Southern Europe, and Arabia.

Thus the material obtained is, from a zoogeographical standpoint, predominantly Ethiopian; but I have elsewhere remarked that Hymenoptera were not the primary object of the Expedition, and the small collections made of the groups under review represent part of the results of general insect-collecting, carried on amid many moves from place to place. Intensive collecting of these families might reveal a Palearctic element in the fauna of the Abyssinian highlands.

LOCALITIES.—Among the places mentioned, Addis Ababa, the Hawash River, Lake Zwai, Lake Hora Abjata (immediately south of the preceding), and the Harar district are well known. Giving distances, "as the crow flies," Jem-Jem Forest is about 45 miles nearly due west of Addis Ababa. Doukam is the name of a river and a railway-station about 20 miles south-east of the capital. Mt. Zukwala, an extinct volcano, lies between 30 and 40 miles from Addis Ababa, a little E. of S., and Wambar Mariam is a village on its lower slopes. The Muger Valley, at the point referred to, is about 30 miles from the capital, W. of N. I have explained elsewhere the difficulty of tracing "Maraquo," where Kovacs collected in 1914, and "Higo Samula" and "Gatelo Amaiyu," where Stordy collected in 1911. The two latter are probably E. of the S. end of Lake Abaya [Margherita].

TYPES of the new species in the British Museum.—H. S.]

Sphegidae.

NOTOGONIDEA Rohwer.

(*Notogonia* suett.)

Notogonidea solstitialis F. Smith, 1856; Arnold, Sphegidae of South Africa, Ann. Transvaal Mus. ix. p. 238, 1923.

Loc. Abyssinia: Muger Valley, ca. 5500 ft., 28-29.

xii. 1926, 1 ♂ (*Scott*). Widely distributed in Tropical and South Africa.

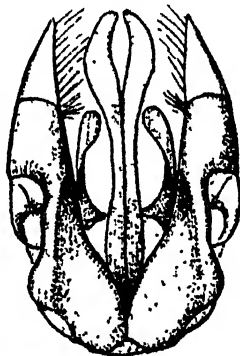
Notogonidea egregia Arnold, *op. cit.* xiii. p. 395, 1929.

Loc. Abyssinia: same place and time as preceding species, 1 ♂ (*Scott*). The type of this species was taken at Coquilhatville, Belgian Congo.

Notogonidea abyssinica, sp. n. (Fig. 1.)

♂.—11 mm. long. Exceedingly like *N. angustiventris* Arn. in colour, sculpture, and proportions of the various segments. The wings are slightly darker and the puncturation of the mesonotum is finer and a little closer. The shape of the clypeus is the same, but the eyes are a little more divergent below than in the other species. The apical margin of the seventh tergite is shallowly concave, whereas in *angustiventris* it is straight.

Fig. 1.



Notogonidea abyssinica, ♂; genitalia.

The genitalia differ considerably from those of *angustiventris* and resemble those of *N. felina* Arn. very closely. The species can be distinguished from *felina* by the difference in the colour of the tarsi, which are black, and by the dull surface and different sculpture of the epinotum. The venation is like that of *angustiventris* *.

* The two species with which *N. abyssinica* is compared, namely *N. felina* and *N. angustiventris*, are recorded from Rhodesia, the former also from Natal.

Loc. Abyssinia : between Addis Ababa and Jem-Jem, 7000–8000 ft., 11–14. x. 1926, 1 ♂ (*Scott*).

PASSALÆCUS Shuckard.

Passalæcus braunsi Kohl, 1905 ; Arnold, *op. cit.* x. p. 52, 1923.

Loc. Abyssinia : Addis Ababa, ca. 8000 ft., i. 1927, 1 ♀ (*Scott*) ; Harar district (*Kristensen*). Belgian Congo, S. Rhodesia, and widely spread in South Africa (Transvaal and Natal (*Arnold*)) ; Cape Province, several localities, series in Brit. Mus. collected by *R. E. Turner*).

PISON Jurine.

Pison montanum Cameron, 1910 ; Arnold, *op. cit.* xi. p. 4, 1924.

Loc. Abyssinia : Addis Ababa, ca. 8000 ft., i. 1927, 1 ♂ (*Scott*). The type was described from Kilimanjaro (rain-forest above 6000 ft.) and the species also occurs in Rhodesia and many parts of South Africa.

PHILANTHUS F.

Philanthus læfflingi Dahlbom var. *meneliki* Arnold, *op. cit.* xi. p. 150, 1925.

Loc. Abyssinia : Doukam, 6500–7000 ft., 20. x. 1926, 1 ♂ (*Scott*) ; Harar district (*Kristensen*). The typical form of the species is distributed over the whole Ethiopian Region.

Philanthus ugandicus Magretti, 1908 ; Arnold, *l. c.*

Three specimens collected were determined by *R. E. Turner* as a variety of this species.

Loc. Abyssinia : Wachacha Ravine, near Addis Ababa, ca. 8000 ft., 9. ix. 1926, 1 ♂ (*Scott*) ; between Jem-Jem and Addis Ababa, 7000–8000 ft., 11–14. x. 1926, 1 ♀ (*Scott*) ; Mt. Zukwala, ca. 9000 ft., 24–25. x. 1926, 1 ♂ (*Omer-Cooper*). The British Museum has examples of the same variety from Addis Ababa, 1911 (*R. J. Stordy*) and Harar district (*Kristensen*). The typical form is distributed all over Eastern Africa to Natal.

CERCERIS Latr.

Cerceris kilimandjaroensis Cameron, in Sjöstedt's Kilimandjaro-Meru Expedition ii. p. 277, 1910; Arnold, *op. cit.* xiv. p. 185, 1931.

Loc. Abyssinia: Doukam, 6500–7000 ft., 18. x. 1926, 1 ♀ (*Scott*); Higo Samula and Hawash R., 1911 (*R. J. Stordy*); Harar district (*Kristensen*). The species was described from examples taken on Mt. Kilimanjaro, between 4000 and 6000 ft. Specimens in the British Museum from Uganda (Mt. Kokanjero, 6400 ft., and Southern Toro), Kenya, and South Africa have since been referred to it.

Cerceris sp., ♂.

Very close to the South African *C. spinicaudata* Cam. Possibly representing a new species, but in the absence of ♀ examples it would be unwise to name the ♂ specimens.

Loc. Abyssinia: Mt. Zukwala, Wambar Mariam, ca. 7000 ft., 28. x. 1926, 3 ♂ (*Scott*).

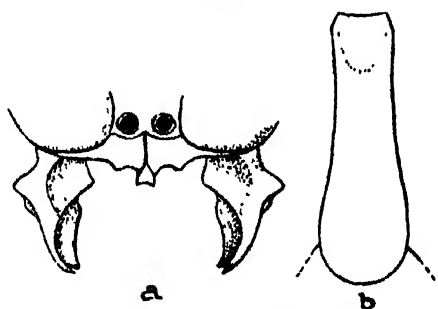
THYREOPUS Lep.

Thyreopus (species-group *Dasyproctus*) *cedignathus*, sp. n. (Fig. 2.)

♂.—0.5 mm. long. Black. Scapes yellow; a band on the pronotal collar interrupted in the middle and attenuated outwardly, a transverse macula on each side of the second tergite, transverse bands halfway between the base and apex on the fourth and fifth tergites, and a narrow basal band on the sixth tergite pale yellowish-white. Anterior and middle tibiae, tarsi and extreme apex of the femora, ferruginous; the middle tibiae behind and the middle tarsi towards the apex darker or fusco-ferruginous. Tegulae ferruginous. Clypeus with silvery pubescence. The pilosity is fine and whitish, very scanty on the head, abdomen and dorsal surface of the thorax, more abundant on the ventral surface of the latter, dense and almost shaggy on the underside of the middle femora and tibiae. The facial concavity is shining, the rest of the body dull. Vertex in front of the ocellar area closely and fairly coarsely punctured,

the rest of the vertex and the temples very sparsely punctured. The facial concavity is margined above by an obtusely angular carina. The median lobe of the clypeus is like that of *Dasyproctus dubiosus* Arn., but narrower and produced a little further forwards. The fifth joint of the flagellum is excavated below and slightly dilated at the apex, as in *D. bipunctatus* Lep. Mandibles strongly and angularly dilated on the outside near the base. Anterior epinemium nitidulous and finely punctured, the posterior one nearly dull and coarsely punctured. Mesonotum sparsely and shallowly punctured and with a few short longitudinal rugæ in the middle behind. Scutellum strongly and longitudinally rugose on the posterior half, sparsely punctured on the anterior.

Fig. 2.

*Thyreopius (Dasyproctus) adsignatus*, ♂.

a, part of head, showing clypeus and mandibles, the latter opened; *b*, petiole.

Postscutellum coarsely reticulate. Epinotum coarsely reticulate above outside the median triangular area; the latter is defined on each side by a shallow clathrate groove and has six longitudinal carinæ which do not quite reach the marginal grooves. The sides of the epinotum are transversely and closely striate and also punctured on their upper third. The median sulcus of the declivity is deep. Petiole widest beyond the middle, three times longer than wide there and nearly twice as long as the second tergite. Apical tergite bluntly triangular. The calcaria are brownish-ochreous. Hind tibiae with three feeble spines on the outside.

Loc. Abyssinia: Jem-Jem Forest, nearly 9000 ft., 24. ix. 1926, 1 ♂ (*Scott*).

A species easily recognized by the angular dilatation of the mandibles.

SCELIPHRON Klug.

Sceliphron spirifex L.; Arnold, *op. cit.* xii. p. 244, 1928.

Loc. Abyssinia: S.E. of Lake Zwai, ca. 5500 ft., 10-13. xi. 1926, 4 ex. (*Omer-Cooper*); Maraquo, v. 1914 (*Kovacs*). Very widely distributed about the Mediterranean and all over Africa, also Southern Arabia (Qara Mts., 1350 ft., xi. 1930, *Bertram Thomas* *).

SPHEX L.

Sphex bonæ-spei Lep.; Arnold, *l. c.* p. 275.

Loc. Abyssinia: plains N. of Lake Zwai, 5500-6000 ft., 3-4. xi. 1926, 1 ♀ (*Scott*); S.E. of Lake Zwai, ca. 5500 ft., 10-13. xi. 1926, 1 ♀ (*Omer-Cooper*); Harar district (*Kristensen*); Maraquo, xi. 1914 (*Kovacs*). The Abyssinian examples were determined by R. E. Turner †. The species was previously recorded from South Africa.

ARPACTUS Jurine.

Arpactus monstrosus Handlirsch, 1894; Arnold, *op. cit.* xiii. p. 245, 1929.

Loc. French Somaliland: Ambouli Oasis, near Jibuti, 29. i. 1927, 1 ♂, 1 ♀ (*Scott*); determined by R. E. Turner. Recorded from East Africa, Rhodesia, and South-west Africa.

STIZUS Latr.

Stizus bidens, sp. n. (Fig. 3.)

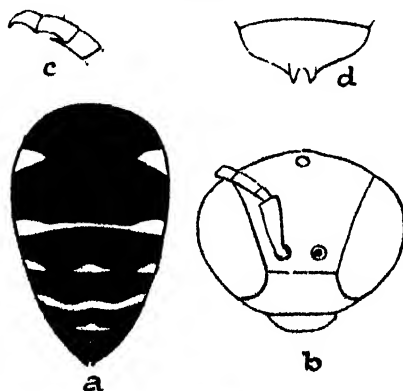
♂.—7-8 mm. long. Black. Labrum, clypeus, face below the antennæ, a narrow line on each side of the lower half of the face, tegulæ, tibiae and tarsi, apical half or more of the fore and middle femora, and apex of the hind femora, lemon-yellow. The posterior margin of the

* Specimens determined by R. E. Turner. Record published in 'Geographical Journal,' lxxviii, p. 234, Sept. 1931.

† Some examples from Harar and Higo Samula were previously determined by Turner as *ferrugineipes* Lep., now regarded as a variety of *bonæ-spei*.

pronotal collar and oval spot on each side of the scutellum, a large transverse macula narrowed inwards on each side of the first tergite, an apical band dilated outwardly on the second, median and lateral maculae on the third, an apical band widened in the middle and at the sides on the fourth, an apical band widest in the middle and not reaching the lateral margins on the fifth, and a small transverse macula on the sixth tergite, whitish-yellow. Flagellum black above, dirty yellow below, the apical joint brownish-ochreous above. Wings hyaline, the veins blackish. There is a fine, sparse, outstanding and yellowish-white pilosity all over, together with

Fig. 3.

*Stisus bidens*, ♂.

a, abdomen ; b, head ; c, last three joints of the flagellum ;
d, seventh tergite.

a decumbent pubescence on the thorax and sternites. On the tergites there is a shorter and brownish pilosity mixed with the whitish. Anterior margin of the clypeus straight. Interocular distance on the vertex equal to the length of the first seven joints of the flagellum and two and two-thirds greater than the interocular distance across the base of the clypeus. Flagellum as in the *tridens* group, to which this species belongs. The second joint is half as long again as the third, the tenth is produced into a short spine at the apex, the

eleventh is arcuately emarginate below and nearly half as long again as the tenth, and the apical joint is rostrate. Mesonotum, mesopleuræ, and scutellum shallowly and very sparsely punctured, the metanotum a little more closely and more deeply. The epinotal dorsum is shallowly punctured, closely so on the median area, sparsely outside it. The lateral margins of the declivity are deeply excised, the angles of the excision as acute as in *S. braunsi* Handl. Seventh tergite closely punctured and with two sharp teeth in the middle of the apical margin. The sternites are unarmed.

♀.—7 mm. long. Clypeus and labrum black; face black, excepting a narrow line on each side of the lower half, which is yellow. Middle tibiæ with a black spot below at the apex; hind tibiæ yellow, black at the base and apex. Basal and apical joints of the hind tarsi blackish, the other three joints brownish-ochreous. Sixth tergite entirely black. Otherwise like the ♂, excepting the usual sexual differences in the antennal joints.

Loc. Abyssinia: Maraquo, xi. 1914, 4 ♂, 2 ♀ (*Kovacs*).

BEMBEX F.

Bembex massaica Cam., 1910; Arnold, *op. cit.* xiii. p. 365, 1929.

Loc. Abyssinia: sandy banks of Hawash River, near Jilli, ca. 5500 ft., i. xii. 1926, 6 ♂ (*Scott*); Harar district (*Kristensen*); all determined by R. E. Turner. East and Central Africa, Rhodesia.

Psammocharidae.

CRYPTOCHILUS Panzer.

Cryptochilus stordyi Arnold, Psammocharidae of the Ethiopian Region, Ann. Transvaal Mus, xiv. p. 375, 1932.

Loc. Abyssinia: Jem-Jem Forest, nearly 9000 ft., 1. x. 1926, 1 ♀ (*Scott*); Mt. Zukwala, ca. 9000 ft., 24–25. x. 1926, 1 ♀ (*Omer-Cooper*); Higo Samula, x. 1911, and Gatelo Amaiyu, xi. 1911 (*Stordy*); Harar district (*Kristensen*). Apparently unknown outside Abyssinia.

CYPHONONYX Dahlbom.

Cyphononyx optimus Smith, 1855; Arnold, *t. c.* p. 298.

Loc. Abyssinia: Jem-Jem Forest, 8000-9000 ft., 20. ix.-10. x. 1926, 3 ♂, 3 ♀ (*Scott, Omer-Cooper*); Higo Samula, x. 1911, and Gatelo Amaiyu, xi. 1911 (*Stordy*); determined by R. E. Turner. Widely distributed over Eastern Africa to South Africa.

Cyphononyx croceicornis Er., 1844; Arnold, *t. c.* p. 301.

Loc. Abyssinia: plain N.W. of Lake Zwai, 5500-6000 ft., 31. x.-1. xi. 1926, 1 ♀ (*Scott*); determined by R. E. Turner. Widely distributed in Africa, excepting possibly the extreme south; also Arabia (Qara Mts., *Bertram Thomas* *) and South Europe (specimens in Brit. Mus.).

PSEUDAGENIA Kohl.

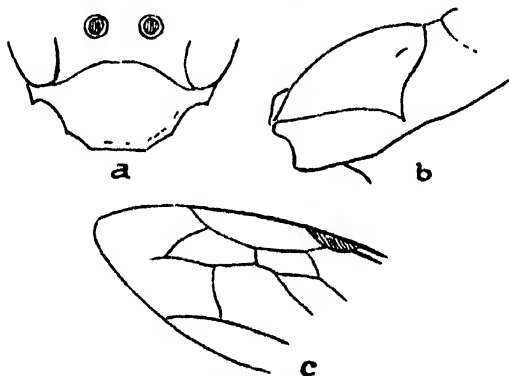
Pseudagenia kovacsi, sp. n. (Fig. 4.)

♀.—16-17 mm. long. Black. Apical third of the mandibles, the scapes below, and a narrow line on each side of the face, fusco-ferruginous. Femora, tibiae, and the first four tarsal joints ferruginous, the apical joint blackish. The extreme apex of the first four tarsal joints infuscated. Wings deep fuscous, with a dull purplish lustre. Pubescence black. On the head, prothorax, mesopleuræ, and anterior coxæ below there is a long thin blackish pilosity, nowhere dense. The base of the first tergite, the sternites, and apical tergite with shorter and scantier pilosity of the same colour. The extreme apex of the sixth tergite is fusco-ferruginous. Dull, except the abdomen, which is slightly shining below the microscopic pubescence; the sixth tergite is triangular, shining, and strongly punctured, the puncturation becoming gradually finer towards the apex. Postnotum transversely striate; anterior half of the metapleuræ vertically striate. Epinotum transversely striate and also finely rugose, the rugæ fairly close and becoming gradually stronger posteriorly. Clypeus very convex, twice as wide as long, the anterior margin truncate in the middle, oblique at the sides. Interocular distance on the vertex equal to four-fifths of the length

* Recorded under the synonym *C. bretoni* Guér., 'Geographical Journal,' lxxviii. p. 234, Sept. 1931.

of the second joint of the flagellum. Posterior ocelli two and a half times farther from the eyes than from each other. Flagellum long and slender, the second joint nearly eight times longer than wide at the apex and a little more than one-third longer than the third joint. Metanotum fairly convex, not longer than the postnotum. Dorsum of the epinotum with a shallow median longitudinal groove. The transverse groove on the second sternite is situated at the basal third of the segment. Hind tibiae cylindrical, without any longitudinal carina, as long as the hind femora and with very small and sparse spines. Third abscissa of the radius barely longer than the second. First recurrent

Fig. 4



Pseudagenia kovacsi, ♀.

a, clypeus; b, epinotum; c, apical half of fore wing.

vein enters the second cubital cell a little beyond the middle, the second recurrent enters the third cubital cell almost at the middle.

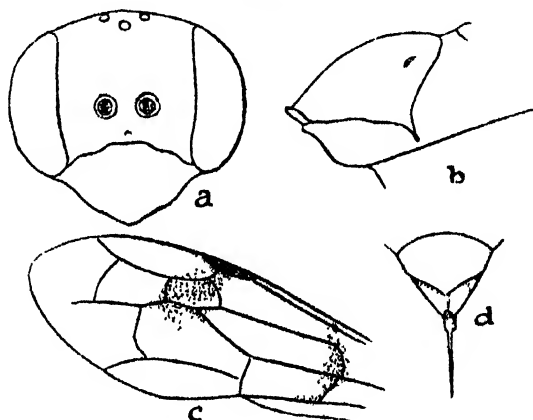
Loc. Abyssinia: Maraquo, xi. 1914, 1 ♀ (*Kovacs*); Higo Samula, 1911, 1 ♀ (*Stordy*).

Pseudagenia lissopyga, sp. n. (Fig. 5.)

♀.—11 mm. long. Black. Apical third of the mandibles and extreme apex of the clypeus fusco-ferruginous. Antennae ferruginous, becoming gradually darker towards the apex, so that the last four joints are black. Femora,

tibiae, and tarsi ferruginous, the extreme base of the femora and the apical joint of the tarsi blackish. Wings hyaline, with a faintly smoky tinge all over; there is a fuscous band margining the basal vein and the nervulus which is twice as wide beyond the veins as behind them, and there is also a fuscous cloud which covers the basal third of the radial cell, the whole of the second cubital cell, the upper median part of the second discoidal, and the upper corner of the apex of the first cubital cell. Clypeus and face with a thin greyish pubescence. The head, pronotum, sides of the thorax, and the epinotum have a sparse, erect, and yellowish

Fig. 5.

*Pseudagenia lissopyga*, ♀.

a, head; b, epinotum; c, fore wing; d, apex of abdomen.

pilosity. Abdomen with a pruinose bloom, the apical segment with a few long yellowish-brown hairs. Post-notum transversely striate and moderately shining, the sixth tergite smooth and shining, the sides of the first tergite slightly shining, the rest of the body dull. Head microscopically reticulate-punctate. Clypeus long and produced, only one and a half times wider than long, the basal half strongly convex in the middle, the apical margin acutely angular. Inner orbits slightly convergent below. The antennal sockets are separated from the clypeus by a distance equal to twice the length of the

first joint of the flagellum or nearly half the length of the clypeus. Posterior ocelli half as far again from the eyes as from each other. Interocular distance on the vertex nearly equal to the length of the first two joints of the flagellum. The second joint of the flagellum is five times longer than wide at the apex and one-fourth longer than the third joint. Pro-mesonotum, scutellum, and metanotum microscopically reticulate-punctate, the mesopleuræ and metapleuræ finely rugulose. Hind margin of the pronotum arcuate. Mesonotum two-fifths wider than long; scutellum very convex, two-thirds as long as the mesonotum. Postnotum in the middle as long as the metanotum. Epinotum closely and finely transversely rugose, here and there also somewhat reticulate. The transverse groove of the second sternite is situated at the basal third of the segment. Sixth tergite obtusely angular at the apex. Hind tibiæ slightly longer than the hind femora, very sparsely spinose. Third abscissa of the radius about one-third longer than the second; the second cubital cell on the cubitus is twice as long as the second transverse cubital vein. The two recurrent veins both meet the cubital cells before the middle.

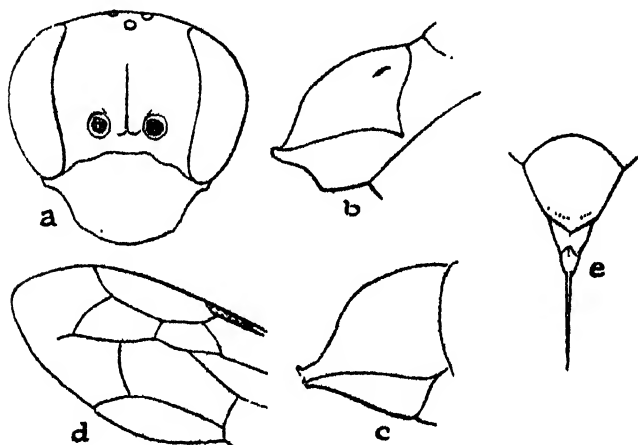
Loc. Abyssinia: Addis Ababa, over 8000 ft., i. 1927, 1 ♀ (*Scott*).

Pseudagenia hirticeps, sp. n. (Fig. 6.)

♀.—11.5 mm. long. Head, pronotum, tegulæ, mesonotum, scutellum, disc and hind margin of the metanotum, ferruginous, but with the following parts black:—hind margin of the clypeus, a line widest below and sinuate outwardly on each side of the middle of the face and reaching from the hind margin of the clypeus to a little above the supra-antennal tubercle, a large spot on the sides of the pronotum, three triangular maculæ on the anterior margin of the mesonotum and the extreme lateral margins of that segment. The rest of the thorax is black. First three abdominal segments and the base of the fourth black, the remaining segments dark ferruginous. Legs ferruginous, the anterior coxæ excepting the apex, and the middle and hind coxæ on the upper surface but excluding the apex, black. Wings faintly fusco-hyaline, with a faint purplish lustre,

the base of the costa ferruginous, the veins and stigma blackish. Head, prosternum, and anterior coxæ with a long, erect, and fairly abundant black pilosity. A shorter pilosity of the same colour is also present on the sides of the thorax, epinotum, sternites, and apical tergite. There is a thin yellowish pubescence underlying the pilosity on the head and pronotum. Clypeus about two-thirds wider than long, strongly convex, the apical margin convex and smooth, the lateral margins feebly concave. Inner orbits convergent below. Interocular distance on the vertex equal to the length of the first

Fig. 6.

*Pseudagenia hirticeps*, ♀.

a, head ; b, epinotum ; c, first abdominal segment ; d, apical half of fore wing ; e, apex of abdomen.

two joints of the flagellum. Posterior ocelli twice as far from the eyes as from each other. Second joint of the flagellum four and a half times longer than wide at the apex and one-fourth longer than the third joint. Thorax, excepting the postnotum, dull. Hind margin of the pronotum obtusely angular. Mesonotum half as wide again as long. Scutellum about two-thirds as long as the mesonotum, moderately convex. Postnotum transversely striate, two-thirds as long as the

metanotum. Epinotum finely and closely transversely rugose, shallowly impressed lengthwise in the middle. In profile the arc formed by the dorsum and declivity is not low, as the declivity is subvertical. The declivous anterior slope of the first tergite is steep, more so than in the majority of the species of the genus. Sixth tergite triangular, very sparsely and finely punctured, the base and apical margin slightly shining. Hind tibiae very feebly spinose. Second abscissa of the radius seven-tenths as long as the third; the recurrent veins meet the cubital cells very nearly in the middle.

Loc. Abyssinia: Maraquo, v. 1914, 1 ♀ (*Kovacs*).

Very closely allied to *P. ornaticollis* Cam., from which it differs, *inter alia*, by the relatively wider vertex and more angular sixth tergite.

PSAMMOCHARES Latr.

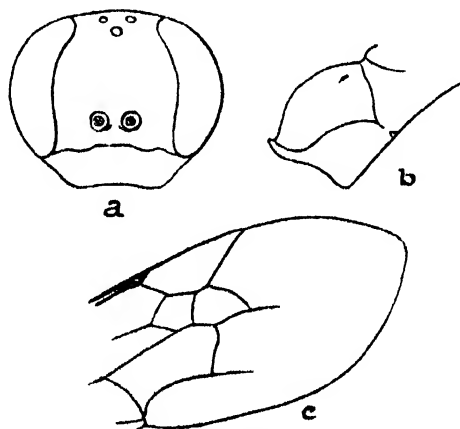
Psammochares (subgen. *Anoplius*) *quadriguttatus*, sp. n.

(Fig. 7.)

♀.—8 mm. long. Black. The first two tergites with a round reddish-orange spot on each side. Wings fuscous, the radial cell and the apical margin up to the cells, darker. Labrum with a fringe of stiff dark brown hairs. Face and pronotum with a few short, thin, and black hairs. Fore and middle coxæ below and the sternites with long exserted black hairs. Sixth tergite with a decumbent black pubescence and long black bristles. Clypeus three and a half times wider than long, the apical margin feebly concave. Inner orbits sinuate, the interocular distance on the vertex slightly less than across the base of the clypeus. Face three times wider than one eye. Interocular distance on the vertex equal to the length of the second joint of the flagellum plus half of the third. The flagellum is fairly short and stout, the second joint is very little longer than the third and four times longer than wide at the apex. Dorsal face of the pronotum as long as the steep anterior face, their junction rounded; the hind margin of the pronotum is angular. Scutellum narrowed posteriorly, about as long as wide in front. Postnotum transversely striolate, depressed, much shorter than the metanotum. Epinotum without sculpture, the dorsum a little longer than the oblique declivity, their junction widely rounded. Anterior

tarsi without a distinct comb, but with long and irregularly spaced spines. Inner calcar of the hind tibia three-fifths as long as the metatarsus. Claws with a tooth in the middle. Radial cell very wide, the first and second abscissæ of about equal length, the third half as long as the second. The first recurrent vein meets the second cubital cell a little beyond its middle, and

Fig. 7.

*Psammochares quadriguttatus*, ♀.

a, head; b, epinotum; c, apical half of fore wing.

the second meets the third cubital cell at its second fifth.

Loc. Abyssinia: Mount Zukwala, ca. 9000 ft., 24-25. x. 1926, 1 ♀ (*Omer-Cooper*).

This species belongs to the group *P. fuscus* L.

BATOZONUS Ashmead.

Batozonus capensis Dahlbom.

Loc. Abyssinia: Doukam, 6000-7000 ft., 18-19. x. 1926, 1 ♀ (*Scott*); determined by R. E. Turner. The British Museum has a specimen from Abyssinia, without exact record of locality (*Kristensen*), and examples from East and South Africa and Uganda.

PARACYPHONONYX Gribodo.

Paracyphononyx lukombensis Cameron, 1912.

Loc. Abyssinia: marsh near Lake Hora Abjata, ca. 5000 ft., 18. xi. 1926, 1 ♀ (*Omer-Cooper*); determined by R. E. Turner. The British Museum has an example from Abyssinia, without precise record of locality, 1911 (*Stordy*), and specimens from Kenya, Uganda, Northern Rhodesia, etc.

List of Species occurring in Abyssinia, of which no Specimens were obtained by the Expedition of 1926-7. (Compiled by HUGH SCOTT.)

This list consists of species of which the British Museum has examples from Abyssinia, taken by earlier collectors, with the addition of eight species of which there are no Abyssinian examples in the Museum. These eight names, given in brackets, were found by searching through Arnold's "Sphegidæ of South Africa" (Ann. Transvaal Mus. ix. 1922-xiv. 1931); I have been unable to follow a similar plan with regard to the Psammocharidæ, since only a small part of Arnold's "Psammocharidæ of South Africa" has as yet appeared, and in this family, therefore, I have had to confine myself to records from Abyssinia based on specimens in the British Museum. Many of these records, in both families, have not been published before, and the subjoined list, though probably far from being a complete enumeration of the known fauna, should make the present paper a more useful contribution to a knowledge of the fauna.

The "earlier collectors" include the two mentioned in the Introductory Note, namely, R. J. Stordy (1911) and O. Kovacs (1914). Besides their captures, many of the specimens were contained in some lots of Hymenoptera collected by Gunnar Kristensen in the Harar district, which were bought and presented to the British Museum by R. E. Turner*. Other collectors were: my friend P. C. Zaphiro, who obtained a few of the specimens recorded below in 1905; the late Edward Degen, who collected some in 1902, mostly at Zegi, on the S.W. shores

* The label "Harar (R. E. Turner)," attached to some of these specimens, may give rise to the impression that Mr. Turner himself has been in Abyssinia. But, though widely travelled in South Africa and elsewhere, he has told me that he has never visited Abyssinia.

of Lake Tana; and Dr. R. E. Drake-Brockman, responsible for a single record (1908).

Besides the species described by him from Abyssinia, Dr. Arnold has determined the Abyssinian specimens recorded below of *Tachytes disputabilis*, *T. inexorabilis*, *Notogonidea thysanomera*, *Cerceris erythroua*, *Stizus dewitzii*, *Bembex agrestis*, *Hemipepsis unifasciatus*, and *Dicyrtomus leptacanthius*. The determination of all the remaining British Museum specimens listed here is due to R. E. Turner.

The eight forms marked * are apparently unknown outside Abyssinia. *Tachytes kristenseni* was unknown elsewhere, but Turner subsequently referred two examples from South-west Africa to this species. The remaining species are all more or less widely distributed in the Ethiopian Region, especially in East and South Africa. *Chlorion umbrosum* (s. l.) ranges over all Africa and the Oriental Region. *Chlorion aegyptium* extends into the southern part of the Palearctic; *Philanthus pallidus*, *Sphex propinqua*, and *Chlorion xanthocerum apicale* appear to have a rather similar distribution. *Oxybelus lamellatus* (if the specimens are rightly identified) appears to occur throughout the Ethiopian Region and in Algeria as well.

The data attached to the Abyssinian specimens of these widespread forms are not always very full, but probably many of them were collected at lower altitudes than those in which the Expedition of 1926-7 worked. The specimens of *Cyphononyx atropos* and *Chlorion xanthocerum maxillare* obtained by Zaphiro are definitely recorded from only 1500-2000 feet. Some of the species in the list have, however, been found at high altitudes in Kilimanjaro, Ruwenzori, etc.

SPHEGIDÆ.

Tachytes disputabilis Turner. Harar, 1 ♂ of the typical form, 1 ♀ doubtfully referred to this species as a variety (*Kristensen*). Nyasaland, Southern Rhodesia.

Tachytes inexorabilis Turner. Higo Samula (*Stordy*). E. Africa, Uganda, Transvaal, Natal.

Tachytes kristenseni Turner. Harar district (*Kristensen*). South-west Africa: Okavandja (*Turner*).

- Larra proditor* Kohl. Harar district (*Kristensen*). Widespread in Africa.
- Notogonidea thysanomera* Kohl, var. *usambarensis* Cam. Harar (*Kristensen*). The typical form appears to occur in many parts of Tropical and South Africa, and the variety is recorded from East Africa and Zululand.
- Notogonidea sepulchralis* Gerst. Harar district (*Kristensen*); Higo Samula (*Stordy*). Widespread in Africa. (*Palarus rothschildi*, Magretti. Abyssinia (?): Endessa.)
- Philanthus triangulum* F., var. *diadema* F. Harar district (*Kristensen*). Widespread in Africa.
- Philanthus histrio* F. Hawash (*Stordy*). E. and S. Africa (including high altitudes in Kilimanjaro, etc.).
- **Philanthus dichrous* Kohl, race *dolosus* Kohl, var. *abyssinicus* Arnold. Harar district (*Kristensen*). (*Philanthus pallidus* Klug. "Abyssinia, Egypt." The British Museum has specimens from Palestine and N.W. India referred to this species.)
- Cerceris cratocephala* Cam. Harar district (*Kristensen*); Higo Samula (*Stordy*). E. and S. Africa.
- Cerceris erythroua* Cam. Harar (*Kristensen*). E. Africa (the British Museum has specimens from Kilimanjaro, 4000-6000 ft., and the Aberdare Mts., 7000-8500 ft.).
- Cerceris spinicaudata* Cam. (*whiteana* Cam.). Harar district (*Kristensen*). E. and S. Africa.
- Cerceris yngvei* Cam. Harar district (*Kristensen*); Higo Samula (*Stordy*). E. Africa (Kilimanjaro).
- **Thyreopus (Dasyproctus) bipunctatus* Lep., var. Harar district (*Kristensen*); Das and Loddo Hawash (*Stordy*). Typical form, E. and S. Africa.
- (**Belomicrus (Oxybelomorpha) mirificus* Kohl. "Abyssinia.")
- Oxybelus lamellatus* Ol. (?). Harar district (*Kristensen*); base of Mt. Fantali †; 23. viii, 1908 (*Drake-Brockman*). This species appears to range over all the Ethiopian Region and to occur in Algeria also.
- **Oxybelus harraricus* Arnold. Harar district (*Kristensen*).
- **Oxybelus pilosus* Arnold. Harar district (*Kristensen*).

† Mt. Fantali is almost due E. of Addis Ababa, nearly 80 miles in a direct line. It lies just N. of Metahara, a station on the railway.

- Oxybelus curviscutis* Arnold. Harar district (*Kristensen*).
South Africa.
- Oxybelus ruficaudis* Cam. Harar district (*Kristensen*).
South Africa.
- **Ampulex kristenseni* Turner. Harar district (*Kristensen*).
Sceliphron quartinx Grib. Harar district (*Kristensen*);
Alaba and Higo Samula (*Stordy*). E. Africa.
- Sceliphron eckloni* Dahlb. Harar district (*Kristensen*).
Widespread in Africa.
- Sphex tydei* Guill., var. *capensis* Lep. Harar district
(*Kristensen*). E. and S. Africa.
- Sphex beniniensis* Pal. de Beauv. Maraquo (*Kovacs*).
Widespread in Africa.
- Sphex tenuis* Pal de Beauv. Harar district (*Kristensen*);
Higo Samula (*Stordy*). Widespread in Africa.
- Sphex insignis* Sm., race *promontorii* Kohl. Maraquo
(*Kovacs*). Widespread in Africa.
(*Sphex propinqua* Tasch. "Abyssinia." Egypt, Syria.)
(**Sphex gracillima* Tasch. "Abyssinia.")
- Chlorion hæmorrhoidale* F. Maraquo (*Kovacs*). Wide-
spread in Africa.
- Chlorion xanthocorum* Ill., var. *maxillare* Pal. de Beauv.,
Harar district (*Kristensen*); Didessa R., Buno †,
1500 ft., 4. v. 1905 (*Zaphiro*). E. Africa.
- Chlorion xanthocorum* Ill., var. *apicale* Guér. Adal ‡,
1902 (*Degen*). E. Africa. The British Museum
has one specimen from Algeria.
- Chlorion simoni* Buyss. Harar district (*Kristensen*).
E. Africa.
- Chlorion umbrosum* Chr. Harar district (*Kristensen*).
Africa and the Oriental Region.
- **Chlorion abyssinicum* Arnold. Harar district (*Kris-
tensen*); Higo Samula (*Stordy*).
(*Chlorion funebris* Berland, 1926. "Abyssinia," 1882
(*Raffray*). E. and S. Africa.)
(*Chlorion ægyptium* Lep. "Abyssinia." Mediterranean,
N. India, etc.)
- Stizus tuberculiventris* Turner. Harar district (*Kristensen*).
E. Africa, Rhodesia.

† I cannot trace Buno, but the Didessa is a long river flowing N.W. into the Blue Nile, and, in its upper parts, between 150 and 200 miles W. of Addis Ababa.

‡ The position of "Adal" in Abyssinia cannot be traced.

- Stizus baumanni* Handl. Harar district (*Kristensen*).
Nyasaland, N. Rhodesia.
- Stizus dewitzii* Handl. Alaba (*Stordy*). Cape Province
and Southern Rhodesia (*teste* Arnold). The British
Museum has specimens from E. Africa, Nyasaland,
Angola, and S.W. Africa referred to this species.
(*Stizus apicalis* Guér. "Abyssinia." W. Africa.)
- Bembex lusca* Spin. Harar district (*Kristensen*). Egypt.
- Bembex agrestis* Parker, 1929. Loddoo Hawash (*Stordy*).
Eritrea: Asmara.
- Bembex diversipennis* Sm. Harar district (*Kristensen*).
Central and S. Africa.
- Bembex capensis* Lep. Alaba, Higo Samula, Das (all
Stordy). E. and S. Africa.

PSAMMOCHARIDÆ.

- Platyderes rhodesianus* Bisch. Harar district (*Kristensen*).
Widespread in Africa.
- Psammochares insidiosus* Sm. Harar district (*Kristensen*).
Nyasaland, S. Africa.
- Episyron natalicolus* Dalla Torre (*fervidus* Sm.). Abyssinia,
without record of locality (*Stordy*). Tropical
Africa.
- Cyphononyx antennatus* Sm. Harar district (*Kristensen*);
Maraquo (*Kovacs*); Zegi, S.W. shore of Lake Tana
(*Degen*). Uganda, Rhodesia, etc.
- Cyphononyx atropos* Sm. Wodessa R. †, Goma, 2000 ft.,
8. v. 1905 (*Zaphiro*). Widespread in Africa.
- Hemipepsis dedjas* Guér. Maraquo, a series (*Kovacs*);
Higo Samula (*Stordy*). E. Africa.
- Hemipepsis tamisieri* Guér. Harar district (*Kristensen*);
also several Abyssinian examples without record
of locality (*Stordy*). E. Africa.
- Hemipepsis tamisieri*, race *combesii* Guér. Higo Samula
(*Stordy*). E. Africa.
- Hemipepsis unifasciatus* Rad. Hawash (*Stordy*). Angola.
- Dicyrtomus leptacanthus* Cam. Higo Samula (*Stordy*).
Described from specimens from the Transvaal.

† This probably refers to a river of that name somewhat over
100 miles W.S.W. of Addis Ababa.

XLV.—*Descriptions and Records of Bees*.—CXLII.

By T. D. A. COCKERELL, University of Colorado.

Tetralonia astragalina clarissima, subsp. n.

♂.—Mandibles with a small light spot at base; clypeus and labrum cream-colour; hair of lower part of cheeks very long and pure white; hair of hind tibiae white; abdominal hair-bands much less conspicuous; apical plate of abdomen black and tapering to the broadly rounded end (instead of broadly truncate and apically reddish). The fox-red hair on thorax above is very bright. The first tergite has long red hair.

Idaho: Blackfoot, June 19, 1932 (*Louise Ireland*).

In the same locality, June 21, Miss Ireland took a male *T. edwardsii* (Cresson).

Tetralonia blanda Walker.

Comparison of types shows that my *T. sudanica*, 1931, is a synonym.

Megachile neavei Vachal.

Belgian Congo: Tenke (*J. O.*); Elisabethville (*W. P. C., A. M., J. O.*).

I examined the type-material in the Congo Museum, and noted:—"11 ♀s., in bad condition, having apparently been in alcohol; clypeus with a polished band on upper part; sides of face with dense white (slightly creamy) hair; wings dusky; mesothorax entirely dull, no punctures visible under lens; scopa creamy white." I did not at the time recognize my *M. semiulba* in this poor material, but the British Museum has a good series, with both sexes, of *M. semialba*, labelled *M. neavei*, compared with type by Meade-Waldo. They are from Lufira, Katanga, 3500 ft., and Nyasaland. Vachal's description does not agree with *M. semialba* in respect to the abdomen, but the discrepancy is evidently due to the condition of the specimens, and I am now satisfied that *M. semialba* is a synonym.

Megachile mombasica Cockerell.

Belgian Congo: Elisabethville (*J. O.*).

Megachile pennata Smith.

S. Rhodesia: Shangani, De Beers Ranch, May, both sexes (*J. O., A. M.*).

Gronoceras cerberus (Friese).

S.W. Africa : Okahandja, Dec. 3, 1927, to March 1, 1928 (*R. E. Turner*).

Both sexes taken. They are distinctly smaller than Friese describes (*Megachile cerberus*, 1903), the females entirely black, the males with white hair on face. When I described *Gronoceras benguellensis* (1907), I first described the female (which must be considered the type), and referred to the abundant fox-red hair at end of thorax and on basal part of abdomen, and then described the black-haired male. Later Dr. Wellman sent me specimens of both sexes from the Ekuiva Valley, and there was a male with red hair like the original female. There were also black-haired males. I now find that the black-haired males must be referred to *G. cerberus*. That *G. benguellensis* is not a variety of *G. cerberus* is shown by the female mandibles (with large strong teeth) and the shining strongly punctured clypeus (with a shining mark at upper end, but no keel). As stated by Friese the clypeus and mandibles of *G. cerberus* are like those of *G. felina* (Gerst.), though the clypeus is more distinctly keeled.

Megachile barbata Smith.

The British Museum has F. Smith's type (Cape of Good Hope) and a series of other males attributed to this species from Abyssinia, N.E. Rhodesia, and Nyasaland.

On close examination I find six different species, Smith's unique type being the only true example of the species. It may be distinguished by the darkened (not bright ferruginous) tegulæ; the keel of sixth tergite conspicuously denticulate; anterior coxæ without spines; scutellum with grey hair and some black on mesothorax and vertex; anterior femora with a large red area on apical half of inner side; sixth tergite above appearing black, the pale hair very thin and short.

Megachile maculata Smith, 1853.

The type, labelled "Port Natal," is exactly the same as the type of *M. anthidioides* Smith, 1879, from Parana. The South American insect was published earlier (1874) by Radoszkowski under the same name. The species is well known from South America; I have specimens

from Puerto Bertoni, Alto Parana, Paraguay (*Schrottky*). The type of *M. maculata* surely never came from Natal in Africa. Friese reports the species from "Fernando Po ; Kamerun, Itoki," but he must have had some other insect.

Megachile fusciorufa, sp. n.

♀ (type).—Length 12·3 to nearly 15 mm., anterior wing 9 mm.

Black, robust, with broad abdomen, hair abundant and erect ; eyes black ; face and front with pale brownish fulvous outstanding hair, on vertex it is redder, varying to dark fuscous, and on cheeks white ; mandibles massive, short and broad, quadridentate, but the two inner teeth feebly developed ; no subbasal tooth below ; antennæ entirely black ; clypeus ordinary, dull and rugulose, except for a smooth median band, which is quite broad ; lower margin of clypeus simple, except that it is broadly emarginate in middle ; vertex behind ocelli dull ; mesothorax and scutellum densely and minutely punctured, hardly shining ; thorax above with pale reddish hair, varying to fuscous, never brightly coloured ; at sides of thorax it is rather dull white, with an ill-defined reddish tint, on metathorax it is dull white, not conspicuous ; tegulæ dark brown or almost black. Wings reddish hyaline, first recurrent nervure ending more than twice as far from base of second cubital cell as second from apex ; basal nervure falling a little short of nervulus ; stigma dark, hardly developed. Legs black, with pale slightly yellowish hair ; tarsi robust, but hind basitarsi not as broad as tibiæ ; hair on inner side of mid-tibiæ and basitarsi glittering clear red, red also on inner side of hind tarsi ; hind tibiæ below with very long dull white hair. Abdomen dorsally with thin outstanding hair, yellowish white on first tergites and becoming red apically ; no bands whatever, except that in lateral view tergites 4 and 5 seem to have very thin red hair-bands ; ventral scopa entirely bright red, except on last sternite, where it is black.

♂.—Length about 11·3 mm.

Face with long rather dull white hair ; antennæ long and black ; hair of thorax white, thin and dull above ; anterior coxæ with strong spines and a little patch of copper-coloured hair ; tarsi stout, anterior basitarsi

with a rather narrow boat-shaped scale, so that from the outer side the tarsi do not appear specially modified ; white fringe behind anterior basitarsus hardly as wide as joint ; the hair on all the tarsi more or less red, bright red on inner side of hind basitarsi ; abdomen with a rather distinct band of outstanding reddish hair on first tergite, and the margins of the tergites narrowly brown ; sixth tergite above with inconspicuous greyish tomentum, the apex of the transverse keel with a broad, deep, rounded emargination, and on each side of this the margin with about four small sharp teeth ; no apical spines beneath. The male is rather robust and seen from above shows an abdomen which is bandless except the subapical shining band of long pale reddish hairs on fifth tergite ; there are traces of bands at sides of the other tergites. The mesothorax is quite dull.

Nyasaland : Mlanje, March 12, 1913 (*S. A. Neave*). A long series of females and one male in British Museum.

The female runs nowhere on Friese's tables or my manuscript tables, but the male seems close to *M. fulvohirta* Friese, which, however, has fulvous tegulæ and is known in both sexes and clearly distinct. The male *M. fulvohirta* has the antennæ broadened at end, and is probably not really allied.

Megachile mephistophelica Gribodo.

Near Oke Oye, N. Nigeria (*Scott Macfie*) ; Yapi, Gold Coast (*J. J. Simpson*) ; Khartum, one mile east of Burri (*G. B. Longstaff*). Placed with these in the British Museum, and superficially exactly like them, is a specimen of *M. geoffrei* Ckll., from Zungeru, N. Nigeria, Oct. 1911 (*Scott Macfie*).

Megachile amabilis, sp. n.

♀.—Length 16 mm., with long parallel-sided body.

Face densely covered with snow-white hair ; facial quadrangle longer than broad, inner orbits practically parallel ; vertex broad, very densely and closely punctured, with thin extremely short hair ; mandibles broad, with four strong teeth ; antennæ black, flagellum unusually short ; mesothorax densely and quite coarsely punctured ; scutellum rugose ; axillæ large ; sides of metathorax with long pure white hair ; a line of white hair along margin of mesothorax, above tegulæ ; tegulæ black, with

a tuft of white hair in front. Anterior wings with the apical half fuliginous, base hyaline; recurrent nervures joining second cubital cell equally far from base and apex. Legs with black or rusty black hair, bright red on inner side of hind tarsi. Abdomen with clear white hair-bands, broadened laterally; ventral scopa very bright red, black on last sternite; sixth tergite with appressed hair, giving it a pale grey appearance; discs of tergites shining and sparsely punctured. The hind wings also have a fuliginous cloud in apical region.

Port Sudan, type-locality (*N. E. Waterfield*); Arabia (*S. Othman*). British Museum.

A very beautiful species; the wings suggest *M. maxillosa* Guér., but the pattern of the abdomen recalls *M. ken-gracensis* Ckll.

Megachile rufoscapacea (Frieso).

Belgian Congo: Tenke (*Ckll., J. O.*). British E. Africa: Chiromo (*Dr. J. B. S. Old*); S. Rhodesia, Shangani, De Beers Ranch, May 11–12 (*A. M.*).

The Shangani form, compared with the series in the British Museum, differed by the black (instead of clear red) hair fringing basin of first tergite and the ventral scopa black at sides. However, the original *rufoscapacea* was described as having the scopa black at sides. Frieso described this as a variety of *M. laminata* Frieso, but it is certainly a distinct species. It is not a *Gronoceras*, and, though so similar to *G. felina* (Gerst.) in appearance, is not related. *Gronoceras felina* was also taken at the De Beers Ranch, May 8–12 (*J. O., L. O., A. M.*), and at Louis Trichardt, Transvaal, April 4–10 (*J. O.*).

Crociaspidia pretiosa (Frieso).

Uvira, Belgian Congo, Aug. 28–29 (*A. M.*); Fort Johnston, Nyasaland (*P. Rendall*).

Meganomia binghami (Cockerell).

S. Rhodesia: Beit Bridge, April 12 (*A. M., J. O., L. O.*).

Nomia fuscipennis Smith.

This was described from Sumatra. A comparison of types shows that *N. violaceipennis* Cameron, from Borneo, is the same species.

Nomia cinerascens Smith.

Transvaal : Wyllie's Poort, April 5 (A. M.) : male.

This agrees exactly with *N. leviannulata* (Cameron MS.), and seems a little different from the true *N. cinerascens* from Port Natal. It is possible that the Transvaal insect should be separated as a distinct race. Cameron's specimen is from the Transvaal.

Morgania (Omachthes) stordyi, sp. n.

♂.—Length 15·8 mm., anterior wing 10·5.

Head, antennæ, tegulæ, thorax, and legs pure black; abdomen shining bright ferruginous, base of third tergite orange, first tergite with the very broad apical margin red, but the basal portion black, with a pair of very large red spots; hair of head and thorax very short and scanty, dark fuscous, giving the mesopleura a dark brown appearance when seen from in front; a tuft of light brown hair at each side of the large labrum; antennæ 12-jointed, third joint about as long as next two combined; clypeus short and broad, the lower margin shining, the disc dull; supraclypeal area large, somewhat glistening; mesothorax very densely rugoso-punctate, little shining, with a strong median sulcus; scutellum bigibbous. Wings fuliginous, the upper part of marginal cell and the broad outer margin darker than the disc; basal nervure going basad of nervulus; first recurrent nervure joining second cubital cell about middle, second meeting outer intercubitus. Legs shining, basitarsi with reddish-brown hair on inner side; spurs black. Abdomen shining, hardly punctured, without any bands or spots due to hair; apical plate broadly rounded.

British East Africa (*R. J. Stordy*). British Museum.

Known by its large size. *M. fortis* Ckll., from the Transvaal, is similar in most respects, but much smaller, with pale reddish spurs.

Morgania (Omachthes) fortis Cockerell.

The range is extended far northward by two specimens from the Semliki Plains, near south shore of Lake Albert, 2200 ft. (*S. A. Neave*). British Museum.

The wings are redder than in *M. stordyi* and the basal nervure goes less basad of nervulus. In Bischoff's table

this runs to *M. dichrous* (Spin.), being easily separated by the black legs.

Morgania (Omachthes) dichrous (Spinola) (*carnifex* Gerst.).

Pondoland : Port St. John, March 25–31, 1923 (*R. E. Turner*). British Museum. One of each sex.

Morgania (Omachthes) rhodesiana Bischoff.

S. Rhodesia : Lonely Mine, Dec. 26 and 27 (*H. Swale*). British Museum.

Females, with abdomen clear red, without black ; one has the scape and oral region clear red, in the other these parts are dark. I found this species represented in the Rhodesian Museum by a specimen from Scottburgh, Natal, the first tergite deep red with apical part broadly black ; rest of abdomen dark red with black togumentary bands on which are fasciæ of white hair ; legs red ; broad band of white hair across mesopleura ; tegulæ dark red ; labrum, mandibles, and lower margin of clypeus deep red ; flagellum obscure red beneath ; base of metathorax polished. The size given by Bischoff (5.5 mm.) applies to contracted individuals. The type came from Bulawayo, and appears to have been intermediate between the Lonely Mine and Natal forms ; so we must consider the species to be very variable.

Morgania (Omachthes) turneri, sp. n.

♀.—Length about 4.5 mm.

Head and thorax black ; abdomen and legs bright ferruginous ; head considerably broader than long ; face very broad, but orbits converging below ; eyes light grey ; labrum, mandibles, and lower edge of clypeus ferruginous ; antennæ rather long, dark, the flagellum brownish beneath ; face with thin white hair, cheeks with white hair ; under the microscope the facial hair is seen to be beautifully plumose, and the vertex is polished, with large well-spaced punctures ; mesothorax highly polished, with well-separated punctures ; tegulæ large, bright orange-ferruginous, sparsely punctured ; scutellum shining, not bigibbous ; sides of thorax and metathorax, except the bare highly polished middle area, densely covered with white tomentum. Wings greyish hyaline, the apical margin a little darker ; stigma and nervures

dark ; second recurrent interstitial ; outer side of second cubital cell strongly arched outward ; first recurrent nervure joining second cubital cell at about end of first third ; basal nervure going a very little basad of nervulus ; hind wing with seven hooks. Legs red to extreme base. Abdomen broad, shining, hardly punctured, with pure white hair-markings, consisting of a small spot at each side of first tergite, a band at each side of second and third, and almost or quite entire bands on fourth and fifth.

S.W. Africa : Okahandja, Jan. 1-12, 1928 (*R. E. Turner*). British Museum.

Related to such species as *M. rhodesiana*, but easily known by its minute size.

Morgania (Omachthes) minutissima, sp. n.

♀.—Exceedingly similar to the last, being of the same size (4.5 mm.) and style of coloration, but easily distinguished by the abdomen being blackened apically and wholly without the white hair-markings, while the coarsely punctured scutellum is strongly bigibbous. These characters ally it with the larger *M. apicalis* Bischoff, from Willowmore. The wings are hyaline, faintly yellowish, with reddish stigma and nervures ; the second recurrent is interstitial, or, rather, would be but for a curious feature (equally present on both sides), the extreme end of both recurrents being absent and the second also having a break toward the base, while the second intercubitus is also broken ; the first recurrent approaches the second cubital cell just before its middle ; basal nervure going considerably basad of nervulus ; hind wing with six hooks. The region of the mouth is dark, but the flagellum is dull red beneath ; the mesothorax is shining, but more strongly and closely punctured than in *M. turneri*. The appearance of the metathorax is the same in both species.

S. Africa : Aliwal North, C.P., 4350 ft., Jan. 1-13, 1923 (*R. E. Turner*). British Museum.

A related but larger species is *M. appletoni* Ckll., from Somaliland.

I examined the type-male of *M. apicalis* Bischoff in the Transvaal Museum, and noted :—About 5 mm. long ; legs clear red ; abdomen with a large black sub-apical patch and no distinct patches of white hair ;

tegulae very bright red; labrum red; first recurrent nervure far from base of second cubital cell, and second near its end; basal nervure meets nervulus; face with white hair.

Morgania (Morgania) alivalensis, sp. n.

♀.—Length about 8 mm., anterior wing almost 7 mm.

Robust, head and thorax shining black, abdomen clear ferruginous; dense silver-white hair covering face and most of front, cheeks, broad sides of upper border of prothorax, pleura (except a round shining disc on upper part and a large bare punctate area below), posterior part of scutellum, two broad vertical bands on metathorax, and the coxae; similar dense white hair also forming a large round spot at each side of first tergite (and also, less densely, covering basal declivity), broad but broadly interrupted bands on second and third tergites, and very broad entire bands on fourth and fifth; venter with some white hair; mandibles black, obscurely reddish in middle; antennae and tegulae black; mesothorax polished, sparsely but strongly punctured, with a strong median sulcus; scutellum very strongly bigibbous; middle of metathorax polished. Wings rather dilute brown; stigma and nervures black or almost so; basal nervure going only just basad of nervulus; second cubital cell receiving first recurrent nervure considerably before the middle and second near but not at the apex. Legs reddish black, the middle femora at apex beneath and under side of hind femora bright ferruginous; tibiae outwardly densely covered with white hair; spurs dark reddish. Sting emerging from the middle of a circular truncate area. Abdomen shining, feebly punctured.

S. Africa: Aliwal North, C.P., Dec. 1922 (*R. E. Turner*).

Related to *M. gerstaeckeri* (Schulz), the type of which was compared; this latter is distinctly larger and has the legs entirely red. Superficially the insect looks like *Pasites maculatus* Jurine.

Morgania semirufa, sp. n.

♀.—Length about 8.5 mm., anterior wing about 6.7 mm.

Rather slender, with rather the aspect of a *Sphecodes*; shining black, with the first two tergites rather dark

chestnut-red, with the hind margin broadly dusky, and this dusky area on second tergite produced anteriorly to form a broad triangle, the apex of which reaches the base of the segment; extreme base of third tergite (usually concealed) yellowish red; mandibles dark red in middle; clypeus short, highly polished and very feebly punctured; supraclypeal area large, highly polished; antennæ black; scape long, shining; flagellum long, with fine pruinose pubescence; head and thorax with very scanty inconspicuous hair; a greyish-white band on each side of the metathoracic enclosure; face with thin outstanding black hair; mesothorax and scutellum shining, hardly punctured; scutellum with a median depression, but hardly bigibbous; tubercles fringed with greyish hair; tegulæ dark reddish. Wings fuliginous, with dark stigma (which is quite large) and nervures; basal nervure going barely basad of nervulus; second cubital cell long, receiving first recurrent nervure much before the middle and second a considerable distance from apex. Legs black, with the tibiæ and anterior basitarsi more obscurely chestnut-red; spurs dark. Abdomen shining, hardly punctured, with long black hair at sides beyond second tergite, but no light hair; apex broadly truncate. The head is very broad and short.

S. Africa: Worcester, C.P., Sept. 1928 (*R. E. Turner*).
British Museum.

A distinct species, to be compared with *M. capicola* Strand, from Rapenburg, Cape Flats (coll. and det. *R. E. Turner*), as follows:—

Abdomen black beyond base of fourth tergite,
and with a white hair-band on fifth;
head short and extremely broad; wings
dilute fuliginous; legs black, brilliant
white hair at end of mid and hind tibiæ; ♀.

Abdomen black, with first two tergites red;
antennæ black, long; tibiæ red.....

[*cola* (Strand).
M. (Sphecodopsis) capi-

M. semirufa Ckll.

The following four species, 6 mm. long or less, the legs wholly or largely dark, look very much alike. Those from the Little Karroo have the first recurrent nervure much more distant from base of second cubital cell than second from apex; the others have the recurrent nervures about equally distant from base and apex of the cell.

The following table separates the insects on characters of colour and sculpture :—

First two tergites entirely clear red ; tibiae mainly red	[<i>rufula</i> , sp. n. <i>M. (Pseudopasites)</i> 1.
First two tergites not entirely or not red...	
1. Second tergite and apex of first red ; legs black ; wings reddish ; ♂	[<i>leonis</i> , sp. n. <i>M. (Sphecodopsis)</i> 2.
Second tergite black	
2. A clear red band at apex of first tergite, which otherwise is black ; ♀	<i>M. (S.) leonis</i> , sp. n. 3.
First tergite more or less red on disc	
3. Mesothorax coarsely and densely punctured, not appearing polished	[<i>punctatus</i> , sp. n. <i>M. (Pseudopasites)</i> per-
Mesothorax highly polished	<i>M. (Pseudopasites)</i> [<i>politus</i> , sp. n.

Morgania (Sphecodopsis) leonis, sp. n.

♂ (type).—Length about 5·7 mm., anterior wing 4.

Head and thorax shining black ; abdomen black, with second tergite and broad apex of first clear ferruginous ; legs and the long slender 13-jointed antennæ black ; apical half of mandibles red ; head broad, transversely oval ; face with thin erect black hair ; clypeus highly polished ; front rather coarsely punctured ; mesothorax polished, with very weak scattered punctures and very sparse long black hairs ; scutellum weakly depressed in middle, but not bigibbous ; area of metathorax shining in middle, but with a band of grey tomentum on each side ; tegulae rather dark rufous. Wings dilute brown ; basal nervure going far basad of nervulus ; stigma and nervures dark brown ; first recurrent nervure joins second cubital cell before end of first third, and second is a considerable distance from apex. Legs with stiff black hair, hind tibiae with white hair at end. Abdomen rather slender, shining, with long black hair on apical part ; apical plate very broadly rounded.

♀.—Length about 5·5 mm.

Abdomen black, with a broad red band at end of first tergite.

S. Africa : Lion's Head, Cape Town, Aug. 1920 (*R. E. Turner*). British Museum.

This is the smallest species of *Sphecodopsis*, s. str., the others being 7 mm. long or over.

Morgania (Pseudopasites) rufula, sp. n.

♀.—Length about 5 mm., anterior wing 3·5 mm.

Rather robust, head and thorax black, first two tergites

bright ferruginous, the others very dark brown, venter ferruginous, dusky at apex; head broad, orbits converging below; mandibles mainly red, but black at base; sides of face, seen from above, showing much shining white hair; labrum and clypeus with coarse punctures, but surface of clypeus largely hidden by appressed white hair; scape with fine appressed white hair; flagellum dark, faintly brownish; mesothorax shining, but strongly and rather closely punctured; scutellum with a slight median depression; hair of thorax scanty and greyish, dense on anterior part of mesopleura; tegulae dark reddish. Wings dilute brownish; stigma small, nervures dark; first recurrent nervure joins second cubital cell at middle, second not far from apex; basal nervure going a little basad of nervulus. Tibiae and tarsi and femora beneath more or less dusky red; front spurs pale red, the middle and hind ones dark. Abdomen with pale hair on apical part, tending to form bands on fourth and fifth tergites; modified pygidial area short and transverse, pale red, with very fine lineolate sculpture; sting-guide slender, pale red, delicately keeled down middle, apex with fine hairs but not emarginate (thus of the general type of *Pasites*); in lateral view the end of the abdomen appears obliquely truncate.

S. Africa: Little Karroo, C.P., 38 miles E. of Ceres, Nov. 17-25, 1924 (*R. E. Turner*). British Museum.

Allied to *M. aculeata* (Friese), but distinguished by the white-haired face and the colour of the legs.

Morgania (Pseudopasites) perpunctata, sp. n.

♂.—Length about 6 mm., anterior wing almost 5 mm.

Black, including legs and antennae, but a broad dusky red band across the polished first tergite and hind margins of tergites obscurely brownish; head broad; mandibles bright red apically; clypeus dullish, densely and coarsely punctured, with a transverse subapical depression; front dull and densely punctured; very sparse long pale hairs on face and front; mesothorax densely and coarsely punctured; scutellum coarsely punctured, depressed in middle; hair of thorax pale but extremely scanty; area of metathorax shining but minutely striate, sides of metathorax strongly punctured; tegulae very dark, slightly reddish. Wings pale

greyish, stigma and nervures dark; venation about as in *M. leonia*, the recurrent nervures about equally distant from ends of second cubital cell, and the basal nervure going far basad of nervulus. Abdomen moderately shining, almost without hair; apical plate rounded. The antennæ are 13-jointed.

S Africa: Rapenburg, Capo Flats, Oct. 1-14, 1920 (*R. E. Turner*). British Museum.

Allied to *M. algoensis* (Bischoff) and *M. pygmæa* (Friese); nearest to the latter, but larger, with no red spots on second tergite.

Morgania (Pseudopasites) politula, sp. n.

♂ (type).—Length about 5.4 mm., anterior wing 4 mm.

Black, with a large transverse red mark on middle of first tergite; head not very broad, approximately circular seen from in front; face and sides of front covered with white hair; clypeus dull and densely punctured, with a shining rim; antennæ black, 13-jointed; margins of mesopleura and a broad band down each side of metathorax covered with greyish-white hair; mesothorax polished, the punctures well separated; scutellum depressed in middle; tegulæ dark reddish. Wings brownish hyaline, nervures dark; stigma small; basal nervure going a short distance basad of nervulus; second cubital cell receiving first recurrent nervure before middle but beyond end of first third, and second recurrent hardly half as far from apex. Anterior tibiæ mainly red; middle tibiæ red at apex. Abdomen with fine pale grey hair, forming triangular patches at extreme sides of tergites; sixth tergite exposed only as a narrow ring; pygidial plate large and round, with short appressed hairs.

♀.—Length about 5 mm.

Triangular hair-patches at sides of tergites lacking; first tergite obscurely reddish, but no distinct mark; sting-guide light red, with hair as in *M. rufula*, but the structure very short. Related by the venation and other characters to *M. rufula*, but easily separated by the dark base of abdomen.

S. Africa: Little Karroo, (C.P., 38 miles east of Ceres, Nov. 17-25, 1924 (*R. E. Turner*). British Museum.

In Bischoff's table it runs next to *M. algoensis* and *M. pygmæa*, but the abdomen differs.

XLVI.—*The Genus Uroxys (Coleoptera, Copridæ), with Descriptions of some new Species.* By GILBERT J. ARROW.

ALTHOUGH twenty-five species of this curious genus have been recognized hitherto (and a few more are here described), there appears to be no record of the habits or manner of occurrence of any one of them. My attention was directed to them by receiving, amongst the insects taken during the collecting expedition of the yacht 'St. George,' a series which proved to belong to an unknown species of *Uroxys*, taken under strange circumstances in the island of Gorgona, Colombia.

A three-toed sloth (*Bradypus gorgon*) was shot by Col. H. J. Kelsall at a height of about 30 feet from the ground in a small creeper-covered tree in the thick jungle. The animal fell into undergrowth at the foot of the tree, and upon it were found immediately afterwards more than a dozen specimens of the beetle. They were chiefly about the head and neck, and appeared to be "nestling in the fur." Mr. C. L. Collenette, entomologist with the expedition, who took considerable pains to ascertain the facts, was satisfied that sufficient time had not elapsed for the insects to have assembled after the death of the sloth, nor were any other specimens found on carcasses left on the ground, sometimes for a considerable time, or in the course of the intensive search made for insects during twenty-eight days spent on the island. As is well known the Copridæ, with hardly any exceptions, are scavengers, living upon and burrowing into the ground. A few of the minute forms live in the nests of ants or termites, and one or two are known to associate with particular vertebrate animals. In N. America *Onthophagus cynomysi* lives in the burrows of the prairie-dog, and *O. polyphemi* in those of a tortoise. A more remarkable association is that of several Australian species, for which I have formed the genus *Macropocopris*, which are found clinging to the fur of kangaroos. In these there is a special modification of the feet and claws to adapt the insects to this habit, but no such adaptation is found in *Uroxys gorgon*. That it is habitually associated with the sloth may be regarded as certain. The discovery of another but much smaller Coprid, which has been recently described by M. Boucomont and given the name of *Trichillum bradyporum*,

seems to provide confirmation. The latter was found by Mr. F. Nevermann upon the sloth in Costa Rica.

The genus *Uroxys* is peculiar for the fact that the males, instead of the horns upon head and thorax occurring in so many other genera of Coprinæ, have developed various peculiarities in the legs, elytra, and thoracic margins. The genus was first established in 1842 by Westwood, who, not recognizing the sexual character of the peculiarities of his single specimen, regarded them as generic. The first to investigate the fundamental characters and affinities was Harold (1868), who realized the closeness of relationship to the genus *Chæridium*, and selected as the crucial distinctive feature the angulation of the suture between the meso- and metasternum, the lateral groove marking off the thickened margin of the pronotum being regarded as a secondary character. Examination of a much larger number of species than were known to Harold shows the meso-metasternal suture to be highly inconstant, presenting every condition from an acute angle (*U. rugatus* Bouc.) to an extremely obtuse one, and finally a gentle curve (the condition found in *U. productus*, one of the most typical *Uroxys* forms, which Harold himself believed to be identical with the type-species of Westwood. This feature, therefore, will not serve for the critical distinction between the two genera, but the marginal groove of the pronotum appears to be constantly found in all the species with the marked sexual dimorphism distinguishing *Uroxys* and to be always absent in *Chæridium*. The angulation of the thoracic margins and elongation of the fore legs appear to characterize the males of all the species. These two features are correlated, the dilatation of the margin providing a larger cavity beneath for the reception of the produced femora when in the position of repose.

Another characteristic of many of the species of *Uroxys* is a peculiar deep groove at the base of the pygidium.

A key to the species was included by Harold in his paper in 'Coleopterologische Hefte,' iii. 1868, p. 33, but this contains ten species only. The tabulation which follows is not complete, a few of the species which are unknown to me being omitted. These are *U. angulicollis* Boh., *aphodioides* Bates, *inconspicuus* Har., *corniculatus* Har., and *lævipennis* Kirsch. It is likely that *aphodioides* is another

name for *coarctatus* Har. At least Bates has not distinguished it from that species, to which it is evidently very similar if not identical.

U. angulatus and *elongatus* of Harold and *tuberculatus* Lansb., although not known to me, have been included in the table from description. They are distinguished by brackets.

M. Boucomont has been good enough to send me for examination his types of *U. bahianus* and *rugatus*. I have found that the two specimens described as male and female of the latter actually belong to two different species. The male belongs to a species of which Dr. Ohaus has sent me both sexes from Ecuador, while the female appears to belong to *U. latesulcatus* Bates, also from Ecuador. The supposed occurrence of M. Boucomont's specimens in Uruguay therefore seems to me very doubtful. The name *rugatus* should be confined to M. Boucomont's male form, and, as the original description is incorrect, I have redescribed this species from both sexes.

Key to the Species of *Uroxys*.

- | | |
|---|--------------------------------|
| 1 (32). Head without carina or tubercle. | |
| 2 (19). Basal groove of pygidium strongly sinuous or angular. | |
| 3 (4). Pronotum strongly sulcate in the middle | productus, sp. n. [(fig. 1). |
| 4 (3). Pronotum not strongly sulcate in the middle. | |
| 5 (14). Basal groove of the pygidium trisinate. | |
| 6 (11). Eyes large. | |
| 7 (10). Interval between the eyes not much wider than their combined width. | |
| 8 (9). Metallic above | bahianus Bouc. |
| 9 (8). Not metallic above | pymæus Har. |
| 10 (7). Interval between the eyes much wider than their combined width.. | trinitatis, sp. n. (fig. 2). |
| 11 (6). Eyes small. | |
| 12 (13). Pronotum with larger lateral punctures | histeroides, sp. n. [(fig. 3). |
| 13 (12). Pronotum without larger lateral punctures | vincentis Arrow. |
| 14 (5). Basal groove of pygidium angular in the middle. | |
| 15 (16). Groove strongly curved on each side. | sulcicollis Har. |
| 16 (15). Groove not strongly curved on each side. | |
| 17 (18). Pronotum with a slight basal median sulcus | micros Har. |
| 18 (17). Pronotum without a slight basal median sulcus | simplex Wat. |

- 19 (2). Basal groove of pygidium almost straight.
- 20 (21). Pronotum closely punctured *brachialis*, sp. n. (fig. 4).
- 21 (20). Pronotum not distinctly punctured.
- 22 (29). Body elongate, moderately large.
- 23 (28). Meso-metasternal line acutely pointed.
- 24 (25). Elytral striae extremely fine, not distinctly punctured *caucanus*, sp. n. (fig. 5).
- 25 (24). Elytral striae not extremely fine, distinctly punctured.
- 26 (27). ♂, apices of elytra strongly produced. *cuprescens* Westw.
- 27 (26). ♂, apices of elytra not produced. *metallascens* Har.
- 28 (23). Meso-metasternal line almost straight. *lojanus*, sp. n. (fig. 6).
- 29 (22). Body broad, rather small.
- 30 (31). Eyes small and far apart *latus*, sp. n. (fig. 7).
- 31 (30). Eyes large, not far apart. *minutus* Har.
- 32 (1). Head bearing a transverse carina or tubercle.
- 33 (36). Head bearing a simple tubercle.
- 34 (35). Upper surface very shining *coarctatus* Har.
- 35 (34). Upper surface not very shining. [*elongatus* Har.]
- 36 (33). Head bearing a frontal carina or transverse elevation.
- 37 (38). Elytra broadly sulcate *laterulcatus* Bates.
- 38 (37). Elytra finely striate or striate-punctate.
- 39 (40). Upper surface of pronotum and elytra granulate. [*tuberculatus* Lausb.]
- 40 (39). Upper surface of pronotum and elytra very smooth.
- 41 (52). Cephalic carina strong.
- 42 (43). Clypeus transversely rugulose *rugatus* Bouc.
- 43 (42). Clypeus not transversely rugulose.
- 44 (51). Forehead smooth.
- 45 (46). Base of pronotum not distinctly punctured *gorgon*, sp. n. (fig. 8).
- 46 (45). Base of pronotum distinctly punctured.
- 47 (48). Elytral striae distinctly punctured ... *batesi* Har.
- 48 (47). Elytral striae not distinctly punctured.
- 49 (50). Front angles of pronotum containing numerous punctures *aterrimus* Har.
- 50 (49). Front angles of pronotum without punctures *brevis* Wat.
- 51 (44). Forehead punctured *striatus* Har.
- 52 (41). Cephalic carina feeble.
- 53 (54). Body rather broad *dilatocollis* Bl.
- 54 (53). Body rather narrow.
- 55 (56). ♂, elytra with terminal processes ... [*angulatus* Har.]
- 56 (55). ♂, elytra truncate behind *terminalis* Wat. (fig. 9).

Uroxys rugatus Bouc.

Niger, vel late aeneo-niger, nitidus, antennis tarsisque rufis; elongatus, valde convexus; clypeo medio bidentato, grosse ruguloso, fronte fortiter sed breviter transverse carinato; pronoto minutissime punctulato, postice medio leviter sulcato, quam elytra haud latiori, lateribus postice fortiter arcuatis, basi toto punctato-marginato; elytris distincte

punctato-striatis, interstitiis leviter convexis, striis utrinque 2 internis postice fortiter impressis, marginibus apicalibus rotundatis; pygidio lævi, paulo convexo, basi recte sulcato; metasterni medio lævi, lateribus fortiter punctatis, sutura meso-metasternali antice acute angulata:

♂. pronoto paulo longiori, lateribus pone angulos anticos minute angulatis, pedibus anticis gracilibus, femoribus subtus pone apicem minute dentatis, tibiis angustis, vix sinuatis, femoribus posticis latis, antice et postico acute dentatis.

Long. 10.5 mm.; lat. max. 6 mm.

EQUADOR: Loja Villonaco (*Dr. F. Ohaus*, Oct. 1905).

Uroxys rugatus is a narrowly elongate species of which the two sexes differ less than usual in the shape of the body but very strikingly in the legs, the hind femur of the male being remarkable for the sharp teeth at the front and hind edges. It is easily distinguished from the other species with a frontal carina by the strong transverse ridges upon the clypeus in both sexes. The elytral striæ are rather deep and the contained punctures, although fine, are fairly close and distinct.

As already mentioned the specimen described by M. Boucomont as the female of this species really belongs to *U. latesulcatus* Bates. The recorded habitat, Uruguay, is probably incorrect.

The types of the following new species are all in the British Museum Collection:—

Uroxys productus, sp. n. (Fig. 1.)

Niger, antice nitidus, postice subopacus, elongatus; capite omnino lævi, clypeo bidentato, oculis parvis; pronoto lævi, lato, convexo, medio postice sulcato, angulis anticis acutis basi toto punctato-marginato; elytris sulcatis, intervallis convexis, sulcis punctatis, punctis posticis sat magnis, corpore subtus fere toto impunctato, sutura meso-metasternali arcuata, haud angulata:

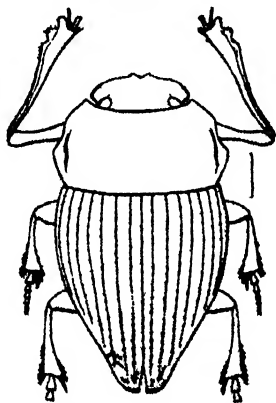
♂. pronoti lateribus post medium obtuse angulatis, antice bisinuatis; elytris basi vix ad thoracis latitudinem æqualibus, deinde angustatis, postice conjunctim caudatis; pedibus anticis longissimis, femoribus attenuatis, muticis, tibiis gracilibus, leviter bisinuatis, femoribus posticis prope basin profunde excisis; pygidio reclinato.

Long. 7 mm.; lat. max. 3.5 mm.

TROPICAL AMERICA.

In Harold's valuable revision of this genus he has stated (Col. Hefte iii. 1868, p. 39) that the type-species, *U. cuprescens* Westw., is the *Pygurus productus* of Dejean's Catalogue. A specimen from Dejean's collection bearing the original label shows that the species is quite distinct and extremely peculiar, and although, as the Catalogue indicates, the origin is unknown (from the colour of the label Dejean appears to have believed it to be Oriental, but a later hand has added "Amer. æquinoct."), it seems desirable to describe so interesting an insect. It is, like Westwood's specimen, a male, but considerably smaller,

Fig. 1.

*Uroxys productus*, sp. n.

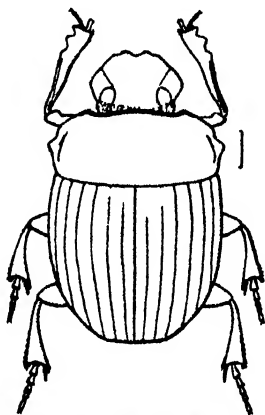
and the elytra, instead of having the sutural angle of each produced into a narrow lobe, are continuously narrowed almost from the shoulders and together form a broad tail-like process. They are very deeply striate, the striae containing punctures which become larger from base to tip, and the intervals are convex and a little opaque. In conformity with this abnormal shape of the elytra the pygidium is almost horizontal in position and inclined inwards, so that the base becomes the extremity. The basal margin bears a strongly trisinate groove, the strong middle curve producing the appearance of a narrow false tip to the pygidium. The pronotum has a longitudinal sulcus. The front legs are very long, the tibia very slender at the base and without trace of the strong

angulation of the inner edge found in *U. cuprescens*. Most of these peculiar features are of course distinctive of the male sex, and the unknown female is no doubt of entirely different appearance.

Uroxys trinitatis, sp. n. (Fig. 2.)

Niger, nitidus, pedibus rufescentibus; late ovalis, modice convexus, capite inermi, laevi, oculis magnis, clypeo medio bidentato, dentibusque minutis 2 exterioribus; pronoto lato, fere impunctato, basi toto minute marginato-punctato, medio haud angulato, sulco laterali longo, ad basin attingenti, elytris leviter striatis, striis minutissime punctatis;

Fig. 2.



Uroxys trinitatis, sp. n.

pygidio basi sulco fortiter trisinuato impresso; corpore subtus laevi, sterno sat lato, sutura meso-metasternali bene angulata:

♂, clypeo leviter punctato, pronoti lateribus post medium fortiter angulatis, antice bisinuatis, femoribus anticiis elongatis, muticis, tibiis anticiis gracilibus, vix sinuatis:

♀, clypeo sat fortiter ruguloso, pronoti lateribus rotundatis, haud angulatis.

Long. 4-4.5 mm.; lat. max. 2.5-3 mm.

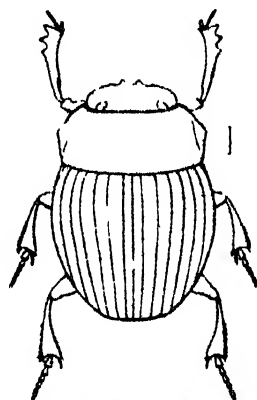
TRINIDAD (*G. E. Bryant*, March).

A number of specimens were found.

This is one of the small and closely similar species allied to *U. minutus*, *pygmaeus*, and *inconspicuus* Har.

in which the pygidium bears a very strongly sinuous basal groove, the true form of which has not been noticed, and a re-examination of Harold's types will be necessary for the exact identification of the above three species. The clypeus of *U. trinitatis* bears feeble outer teeth, as in *U. inconspicuus* (from Uruguay), but it is a broadly oval, not elongate insect. The eyes are large, as in *U. pygmaeus*, of which the type appears to be a rather immature female, but they are evidently not so large as in that species, for the intervening space is considerably wider than the combined width of the eyes. The basal groove of the pygidium is strongly trisinuate, with three nearly equal curves. In *U. micros* Bates and *sulcicollis* Har. the outer curves are much larger and the middle one subangular.

Fig. 3.

*Uroxys histeroides*, sp. n.*Uroxys histeroides*, sp. n. (Fig. 3.)

Niger, nitidus, ovatus, clypeo quadridentato, dentibus externis minutis, fronto inermi, sparse punctato, oculis minutis, pronoto brevi, utrinque irregulariter haud minute punctato, basi subtilissime punctato-marginato, angulis anticis acutis; elytris valde striatis, striis vix perspicue punctatis, interstitiis planis, marginibus apicalibus rotundatis; pygidio laevi, basi profunde impresso, metasterni medio laevi, lateribus sat grosse punctatis, linea meso-metasternali obtuse angulata:

♂, clypeo minute et crebre punctato, tibia antica elongata :

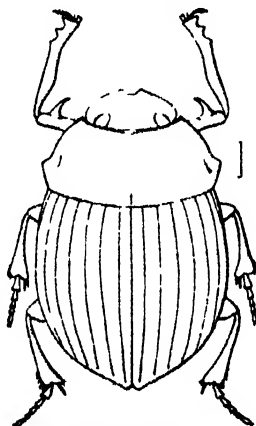
♀, clypeo transverse ruguloso, tibia antica brevi.

Long. 4 mm.; lat. 2.5 mm.

PARAGUAY.

Another small species related to *U. inconspicuus*, *trinitatis*, and *vincentiae*, but most nearly to the last, with which it agrees in the small size of the eyes (seen from above), the intervening space being at least four times the width of one eye. *U. histeroides* is easily distinguished from all other related species by the rather large scattered punctures on each side of the pronotum. The clypeus bears four teeth, of which the outer ones, as usual, are feeble, and is closely and rather deeply punctured in the male and strongly and coarsely wrinkled in the female.

Fig. 4.



Uroxys brachialis, sp. n.

Uroxys brachialis, sp. n. (Fig. 4.)

Niger, nitidus, pedibus rufo-piceis; sat late ovatus, parum convexus, capite bidentato, minute punctato, antice paulo fortius, haud rugoso, fronte plano, pronoto dense punctato, lateribus sublaevibus, basi haud marginato; clytris striatis, striis indistincte punctatis, interstitiis planis, vix perspicue punctulatis; corpore subtus nitido, metasterni medio minutissime punctulato, lateribus grosse arcuatim impressis, sutura mesosternali haud acute angulata :

♂, prothoracis lateribus post medium acute angulatis, antice et postice convergentibus, sulco laterali vix ultra medium

attingenti, elytrorum margine apicali versus suturam recto, ad suturam leviter angulato; pedibus anticis gracilibus, femore elongato, antice prope apicem spino acutissimo armato, tibia elongata, leviter bisinuata, extus brevissime tridentata.

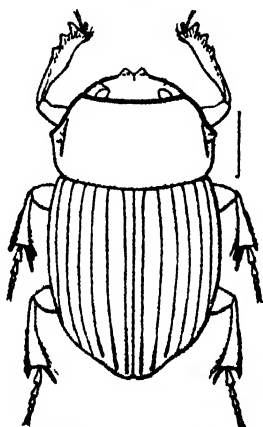
Long. 5 mm.; lat. max. 3.5 mm.

COLOMBIA: Pichinde, 5000 ft. (*W. F. Rosenberg*, Oct.).

The type is a unique male.

The species is unlike any other yet known, rather broad and flat in shape, the slender fore legs of the male being

Fig. 5.



Uroxys caucanus, sp. n.

remarkable in so short an insect. The slightly produced sutural angles of the elytra in the same sex are also quite distinctive.

The closely punctured pronotum is a feature shared only with *U. laevipennis* Kirsch, which appears to differ in most other respects and is considerably larger.

Uroxys caucanus, sp. n. (Fig. 5.)

Cupreo-niger, laevis, nitidissimus, olypeo leviter transverse ruguloso, bidentato, pronoto laevi, serie basali punctorum minorum ad medium haud attingenti; elytris subtiliter striatis, striis vix perspicue punctatis, duabus internis apice fortiter impressis; corpore subtus laevi, metasterni lateribus punctis annulatis irregulariter praeditis, linea meso-metasternali fere recte angulata:

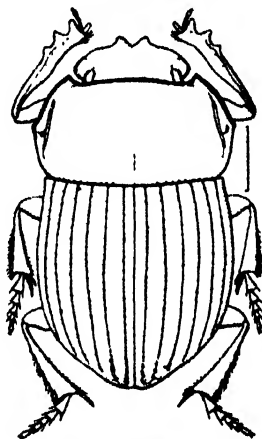
♂, pronoti lateribus medio acute angulatis, antice arcuatim emarginatis; elytrorum apicibus paulo productis, separatim rotundatis; tibia antica elongata, intus paulo ante medium dilatata, haud angulata, subtus sat longe fimbriata, calcare lato, apice leviter bilobato.

Long. 8-9 mm.; lat. 5 mm.

COLOMBIA: Cauca.

This has considerable resemblance to *U. cuprescens* Westw., but the male (the only sex at present known of Westwood's species) has less pronounced characteristics.

Fig. 6.



Uroxys lojanus, sp. n.

The apices of the elytra are only slightly produced and the front tibia is feebly and not angularly dilated. There are positive differences, however, of greater importance. The clypeus is transversely wrinkled and not punctured, the elytra are more finely striate, with less conspicuous punctures in the striae, the front tibia has a long fringe beneath (closer and more apparent in the male than in the female), and the terminal spur of this tibia in the male is not acuminate, but bilobed at the end.

Uroxys lojanus, sp. n. (Fig. 6.)

Niger, leviter cuprescens, nitidus, antennis tarsisque rufis; elongato-ovalis, convexus, capito laevi, clypeo subtiliter punctato-rugoso, antice bidentato; pronoto laevi, lateribus

rotundatis, angulis anticis acutis, basi fere recto, utrinque minute sat fortiter seriato-punctato, elytris subtiliter striatis, striis minute punctatis, intervallis leviter convexis, striis postice fortiter impressis; pygidio laevi, basi fere recte sulcato; mesosterno et metasterni lateribus sat parce punctatis, linea meso-metasternali haud medio angulato:

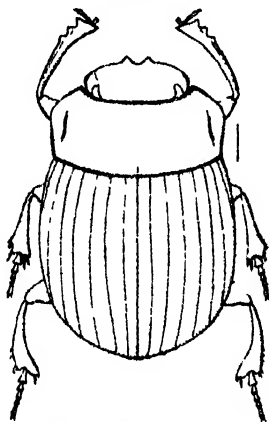
♂, prothoracis lateribus medio acute angulatis, antice sinuatis, elytris postice perpaulo productis; pedibus anticis elongatis, tibiis gracilibus, bisinuatis.

Long. 7-8.5 mm.; lat. 4-5 mm.

ECUADOR: Loja Pucara, Loja Calvario, 6600-6900 ft. (Dr. F. Ohaus, Aug. 1905).

I have received several examples of each sex from Dr. Ohaus. It is a more convex species than *U. caucanus*.

Fig. 7.



Uroxys latus, sp. n.

and the elytra are less elongate. The pronotum is more convex and relatively longer, and has a row of about ten well-marked punctures on each side of the base. The elytral striae are distinctly punctured. The eyes are smaller and farther apart than those of *U. caucanus*. The female is much shorter than the male.

Uroxys latus, sp. n. (Fig. 7.)

Niger, subtiliter cupreo-micans, nitidissimus, sat latus, parum convexus, capite laevi, antice minute bidentato, oculis parvis, remotis; pronoto vix perspicue punctato, basi

utrinque parum distincte punctato; elytris subtiliter striatis, striis minute sat laxe punctatis; pygidio lævi, basi utrinque fere recte sulcato; metasterni medio lævi, lateribus crebre punctatis, linea meso-metasternali obtuse angulata: ♂, pronoti lateribus dilatatis, ante medium obtuse angulatis, tibia antica elongata, tenui, arcuata, dentibus tribus externis exiguis, calcaro brevi truncato.

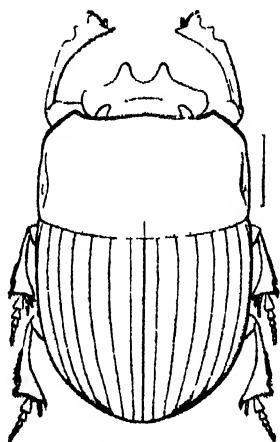
Long. 5 mm.; lat. 3.5 mm.

S. BRAZIL: Petropolis (Rev. Hamlet Clark, Feb. 1857).

I have seen only a single male.

This is a very smooth shining insect, of broad form, with very smooth head, small widely separated eyes, and distinctly but very finely punctured elytra. It appears to resemble *U. minutus* Har., but I believe that to be a smaller species with relatively much larger eyes. The front tibiae (of the male) are long and rather strongly curved in the new species, but those of *U. minutus* are described as only slightly bent.

Fig. 8.



Uroxys gorgon, sp. n.

Uroxys gorgon, sp. n. (Fig. 8.)

Niger, nitidus, antennis tarsisque rufis: breviter subquadrato-ovatus, capite lato, lævi, vix perspicue punctato, carina inter oculos valida, brevi, arcuata, clypeo antice bilobato; pronoto lævi, haud dilatato, lateribus regulariter arcuatis, angulis posticis rotundatis, elytris subtiliter striatis, striis

vix punctatis, duabus internis postice fortiter impressis, intervallis planis, lævibus; pygidio lævi, basi fere recte sulcato; metasterno lævi, punctis nonnullis lateralibus, linea meso-metasternali antice obtuse angulata, femoribus 4 posterioribus obtuse angulatis:

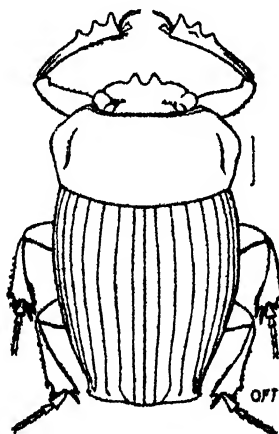
♂, capite utrinque dilatato et recurvato, clypei dentibus anticis productis; prothoracis margine antico paulo retuso, angulis anticis acutis, tibia antica elongata, angusta, valde arcuata.

Long. 6.5-9.5 mm.; lat. 4-6 mm.

COLOMBIA: Gorgona I. (Col. H. J. Kelsall, July 1924).

This species is evidently related closely to *U. corniculatus* Har., but it is larger and has the elytra very lightly and by no means deeply striate. The strong rounded carina upon the head, seemingly absent in Harold's species, is a conspicuous feature. The species also

Fig. 9.



Uroxys terminalis Wat.

resembles *U. batesi* Har. in general appearance, but the carina upon the head is rounded and without sharp angles, the pronotum has only slight vestiges of punctures along the basal margin, and the elytral striae are not distinctly punctured. The produced and upturned sides of the head and the very narrow and elongate front tibiae, in addition to the strong clypeal lobes, will enable the male to be easily distinguished.

More than a dozen specimens of this species were found in the fur of a three-toed sloth shot during the 'St. George' Expedition. The discovery of a Coprid beetle under such circumstances is of great interest in an insect apparently possessed of no special adaptation for such a mode of life.

XLVII.—*Papers on Oriental Carabidæ*.—XXVIII.

By H. E. ANDREWES.

THE accompanying descriptions of new species are published with a view to facilitating the appearance of other works elsewhere. Mr. J. C. M. Gardner, of the Forest Research Institute, Dehra Dun, has sent me examples of several new species of *Dromius* and one of *Calleida*, which are of some economic importance in Northern India. He is now dealing with the life-histories of some of them, and has asked me to name and describe the imagines. In the following pages will be found the descriptions of one new species of *Calleida* and six species and a variety of *Dromius*, together with a key to all the species of the latter genus known to me from the Himalayas. Following these are the descriptions of a new genus from the Malay Archipelago and two new species, from Java and Sumatra respectively, the latter and a new *Amblystomus* for inclusion in my forthcoming Catalogue of Sumatran Carabidæ. At the end a new species of *Bembidion* is described, known to me from Kashmir, but recently discovered also by the Dutch Karakorum Expedition.

Calleida rapax, sp. n. ✓

Length 12–13 mm.

Piceous; elytra bright green, the disk and sometimes the marginal channel deep greenish blue; base and apex of palpi, joint 1 of antennæ, with joints 2–3 in part, vertex, and trochanters more or less ferruginous.

Body winged. *Head* rather flat, contracting rapidly behind, frontal foveæ shallow and uneven, eyes prominent, neck somewhat constricted, surface impunctate. *Prothorax* rather flat, cordate, a sixth wider than head and a fourth wider than long, base oblique at sides, wider

than apex, front angles rounded away, sides narrowly bordered and moderately explanate, a little reflexed, well rounded in front, then nearly straight to base, hind angles obtuse and a little reflexed, hind lateral seta on the angle, front one at two-fifths from apex; median line, transverse impressions at sides, and basal foveæ all fairly deep, the foveæ continued forward on each side as a shallow sulcus, parallel with sides, surface uneven, impunctate. *Elytra* rather flat, slightly depressed behind base, three-fifths wider than prothorax, nearly four-fifths longer than wide, sides slightly compressed behind shoulders and then a little dilated, so that the widest point is well behind middle, apex truncate; striæ moderately deep and very finely punctate, intervals moderately convex, 3 with three pores, at two-fifths, four-fifths, and close to apex, surface with some sparse minute puncturation. Microsculpture of the elytra faint, formed by isodiametric meshes; none on head or prothorax. Underside with some very fine scattered puncturation and pubescence on the metasternum, especially at apex, and on the middle of base and across the middle of the segments of the venter (♂); met-episterna long and narrow; last ventral segment (♂) slightly excised at middle and with a single marginal seta on each side, ♀ with two setæ.

The species is very closely allied to *femoralis* Chaud., *sultana* Bates, and *pallipes* Andr.; I have no examples of the two former for comparison, but apart from considerable differences in coloration *pallipes* has no microsculpture on the elytra, though there are some little patches of pubescence at the apex of metasternum and base of venter (♂) not mentioned in the original description. I should have had some hesitation in describing this as a new species but for the fact that Mr. Gardner informs me he has found differences in the larvæ; in the genus *Calleida* the colour of the legs at least seems to have more value than is often the case in other genera of *Carabidæ*, though the greens and blues of the elytra, especially when, as here, they occur together, are subject to a good deal of variation.

UNITED PROVINCES: Lachiwala (*C. F. C. Beeson*), 1 ex., "under bark of *Tectona grandis*"; Dehra Dun, several examples, including 4 ex. (*J. C. M. Gardner*), "in bamboo leaf roll" (S.E.'s nos. 1223/₂ and 1223/₃), and

1 ex. (*S. N. Chatterjee*), "predaceous on *Hyblaea puera* Cr. and *Hapalia machaeralis* Wlk."; New Forest (*R. N. Mathur*), 4 ex.; Garhwal, Lansdowne, Nauri, 2500 feet (*B. M. Bhatia*), 2 ex., "ex dry bamboo."

Mr. Gardner informs me that *C. splendidula* F., *C. pallipes* Andr., and *C. rapax* Andr. are all predaceous on the bamboo defoliator, *Pyrausta coclesalis* Wlk., at Dehra Dun.

Regarding this species Dr. C. F. C. Beeson wrote me under date 19. xi. 1928, "You may be interested to know that we have kept alive [*i.e.*, at the Forest Research Institute, Dehra Dun] since 3rd Sept. 1927 up to the present date a beetle that feeds on small caterpillars. It fed at the rate of one or two caterpillars a day throughout Sept. and Oct. 1927, four caterpillars in Nov., two in Dec., and nil from Jan. to March 1928, four in April, and regularly from May to October 1928. It has now gone into hibernation, 17. xi. 28."

Key to the Himalayan Species of Dromius.

- 1 (14). Elytra flat, fully a half longer than wide, more or less clearly striate.
- 2 (13). Head and prothorax almost impunctate; mentum edentate.
- 3 (12). Elytral striae clearly impressed, interval 7 seriate-punctate.
- 4 (7). Upper surface almost entirely piceous, without pattern on the elytra. Length from 6 mm. upwards.
- 5 (6). Suture of elytra and lateral margins of both prothorax and elytra ferruginous; prothorax contracted behind, its sides explanate *cremnus*, sp. n.
- 6 (5). Upper surface uniformly piceous; prothorax not contracted behind, its sides explanate close to hind angles only... *codonotus*, sp. n.
- 7 (4). Upper surface with a pattern on the elytra; length not exceeding 6, and rarely more than 5 mm.
- 8 (11). Prothorax uniformly red, its sides evidently explanate; elytra each with two light patches.
- 9 (10). Prothorax with its sides evenly rounded; each elytron with two large oval pale spots, so that in effect they appear flavous, with a large black cross in the middle *indicus* Andr.*.
- 10 (9). Prothorax with its sides nearly parallel, sharply contracted at apex and slightly dilated at base; each elytron with two pale spots, the front one elongate, the hind one small and rounded. *orestes*, sp. n.

* Ann. & Mag. Nat. Hist. (9) xii. 1923, p. 686.

- 11 (8). Prothorax piceous, with pale margins, its sides only slightly explanate; each elytron with an elongate pale spot in front in the form of an inverted comma, the apex with a fairly wide pale margin. *comma*, sp. n.
- 12 (3). Elytral striae lightly impressed, interval 7 not serrate-punctate. Length 4-4.5 mm. *adoxus* Andr.*.
- 13 (2). Head and prothorax closely and conspicuously punctate; mentum with a short obtuse tooth *cymindoides*, sp. n.
- 14 (1). Elytra more or less convex, hardly more than a fourth longer than wide, not or only faintly striate, flavous, with a large black band placed just behind middle.
- 15 (10). Elytra distinctly convex, striae hardly perceptible, without dark spots round scutellum or on shoulders. Length 3.5 mm. *sphex*, sp. n.
- 16 (15). Elytra only slightly convex, striae faintly impressed, with dark spots round scutellum and on shoulders. Length 5 mm. *sphex* var. *ingens*, nov.

Dromius eremnus, sp. n.

Length 6-7 mm.

Ferruginous; head and disk of prothorax brown, elytra piceous, intervals 1, 9, and border ferruginous, the paler colour sometimes extending to intervals 2-3, at least on disk.

Head convex, smooth, with a slight neck constriction, frontal foveæ shallow, eyes moderately prominent. *Prothorax* moderately convex, two-fifths wider than head, a little more than a fourth wider than long, moderately contracted behind, but base much wider than apex, front angles adjoining neck, sides rounded and explanate, more widely behind, hind angles slightly obtuse, rounded, and a little reflexed, the hind seta just before the angle on the border, the front one within the border at a fifth from apex; the normal impressions visible, though rather faint, a slight duplicated impression on each side parallel with margin, basal foveæ small but fairly deep, disk with some cross-striation, base and sides somewhat uneven, finely and rather vaguely punctate. *Elytra* rather flat, elongate-oval, truncate at apex, nearly two-thirds wider than prothorax, four-fifths longer than wide, basal border practically ending at the base of stria 4

though continued inwards as a fine line to scutellary striae; striae moderately deep, indistinctly crenulate, intervals slightly convex, 3 with a single pore near apex, 7 with nine or ten pores adjoining stria 6, marginal series uninterrupted. Microsculpture distinct, isodiametric on head and elytra, the meshes on the prothorax on average rather wider than long. Last dorsal segment deeply emarginate on each side; venter glabrous, last segment ♂ with two marginal setæ on each side, ♀ with three on each side, the external longer than the two inner ones. Claws with half a dozen teeth on each part, which gradually increase in length from base to apex.

Somewhat like the palæarctic *D. agilis* F., but larger and rather darker, the margins and suture of the elytra evidently ferruginous. The prothorax is much less contracted behind, with more widely explanate sides, the elytra rather more deeply striate, interval 7 with more numerous and more conspicuous punctures.

SIKKIM: Gopaldhara (*H. Stevens*), 2 ex., under bark; Pashok (*F. H. Gravely*—Ind. Mus.), 1 ex.; Lopchu (*J. C. M. Gardner*—Forest Res. Inst.), 5000 feet, 1 ex.; Kurseong, 1 ex. PUNJAB: Simla, Kotkhai, Giri River (*C. F. C. Beeson*), 5000 feet, 1 ex. UNITED PROVINCES: Chakrata, Lambatach (*B. M. Bhatia*), 7600 feet, 1 ex.; Dehra Dun (i.) 2 ex., under bark (*M. Bose*), (ii.) 1 ex., "ex dry twigs bored by Lamiidæ, S.E.'s no. 594 (*J. C. M. Gardner*)," (iii.) 1 ex., "ex pupal chamber of a longicorn in dry stick, S.E.'s no. 894 (*J. C. M. Gardner*). All the examples from the United Provinces and Punjab were taken by members of the Forest Research Institute. The type (Gopaldhara) is in my collection.

Dromius codonotus, sp. n.

Length 6 mm.

Piceous; front of head, palpi, antennæ (darker towards apex), legs, and metasternum ferruginous.

Head moderately convex, frontal foveæ shallow, eyes prominent, some longitudinal striation on each side, surface finely and sparsely punctate, more coarsely at sides. Prothorax convex, campanulate in outline, a sixth wider than head, a fifth wider than long, widest across base, front angles adjoining neck, sides gently rounded in front and faintly sinuate behind, hind angles slightly

obtuse and rounded, a little reflexed, though the neighbouring surface is somewhat explanate, hind seta on the angle, front one at about a fourth from apex; the normal impressions fairly distinct, the basal foveæ shallow, surface transversely striate, finely and not very closely punctate. *Elytra* rather flat, subquadrate, truncate at apex, about three-fourths wider than prothorax, three-fifths longer than wide, sides parallel, basal border ending opposite stria 4 but continued as a furrow to a point opposite stria 1; striæ moderately deep and finely punctate, intervals a little convex, 3 with five to seven pores, adjoining stria 3, except the apical one, which is larger than the others, and adjoins stria 2, 7 with about eight pores, adjoining stria 6, marginal series interrupted at middle, surface minutely and sparsely punctate. Microsculpture distinct and isodiametric on the head and elytra; on the prothorax it is indistinct, the meshes being largely fused. Last dorsal and ventral segments as in *cremnus* (♀), the venter glabrous. Claws inwardly dilated at base and showing only one or two small teeth.

A little like the Japanese *D. campanulatus* Bates, but a shorter, wider, duller insect, with more prominent eyes, the microsculpture of the prothorax indistinct, elytral interval 3 as well as 7 pluripunctate, the surface generally more evidently punctate.

UNITED PROVINCES: West Almora (*H. G. Champion*), 1 ex., ♀; Dehra Dun, Dobhalwala, 1 ex. (defective), in my collection. The type is in the British Museum.

Dromius comma, sp. n.

Length 4.5–4.75 mm.

Ferruginous, upper surface piceous; palpi, base of antennæ, front of head, all the margins of prothorax, a pattern on the elytra, and legs more or less flavous. The elytral pattern consists of (i.) a shoulder-spot in the shape of an inverted comma, the point reaching the basal margin on intervals 6–7, and the rounded part, which reaches middle, extending between striæ 3 and 7 but sometimes reaching outer margin, (ii.) an apical border, extending furthest forward on intervals 4–5, but not reaching middle, (iii.) the marginal channel.

Head rather flat, smooth, frontal foveæ shallow, eyes moderately prominent. *Prothorax* rather flat, a fifth

wider than head and as much wider than long, base arcuate, much wider than apex, sides gently rounded in front and slightly sinuate behind, hind angles slightly obtuse, reflexed, and a little rounded, with a seta on the angle, none in front; the usual impressions moderately distinct, surface slightly cross-striate, a few minute punctures along base and sides. *Elytra* rather flat, two-thirds wider than prothorax and as much longer than wide, slightly dilated behind and widest at a fourth from apex, apex truncate, basal border extending inwards to a point opposite stria 3; striae moderately deep, finely crenulate, intervals moderately convex, 3 with a single pore near apex, 7 with six to eight pores, adjoining stria 6. Microsculpture of the head and elytra formed by large, well-defined, isodiametric meshes; on the prothorax the meshes are equally well defined but slightly wider than long. Dorsal and ventral segments as in *eremnus*, but the venter is covered with a fairly long pubescence; claws with four teeth each, gradually increasing in length from base to apex.

Not unlike *D. indicus* Andr., but the upper surface dark instead of pale and the elytra have a rather different pattern; the prothorax is narrower, the sides sinuate behind and not evidently explanate; the elytra are longer and narrower, interval 7 with more numerous and more conspicuous pores.

SIKKIM: Darjeeling, Debrepani, 6000 feet, 1 ex., on *Alnus nepalensis*, and Lopchu, 5000 feet, 4 ex. (all J. C. M. Gardner—Forest Res. Inst.). "Eastern Himalayas," 1 ex. (Bertrand). The type is in the British Museum.

Dromius orestes, sp. n.

Length 4.5–4.75 mm.

Ferruginous; apical joints of antennæ brown; head, prothorax, and scutellary region lighter or darker red; elytra piceous, the border, interval 9, and two spots on each flavous, the front spot elongate, on intervals 3–5, the hind one much smaller, round, on intervals 2–4.

Apart from colour and pattern the head is very much like that of *D. comma*, but the surface is a little rough between the eyes. The prothorax is proportionately wider, a fourth wider than long, with moderately explanate sides, the front lateral seta missing as in *comma*, the surface

more evidently cross-striate. The elytra are wider, rather less deeply striate, but with more evident crenulation, the intervals a little flatter, 3 and 7 similarly punctate. Microsculpture similar on the head and elytra, but on the prothorax the meshes coalesce and it is scarcely visible, though some minute puncturation can be seen. Underside similar, except for the fact that the venter shows only traces of a very short pubescence. The claws have four teeth each of about the same size.

UNITED PROVINCES : Dehra Dun, Lachiwala (*J. C. M. Gardner*), 1 ex., "ex unknown wood," and Kaulagarh (*A. K. Sharma*), 1 ex., "under lump of earth." Both examples were in the collection of the Forest Research Institute, but the type has been placed in the British Museum.

Dromius cymindoides, sp. n.

Length 4.5–5 mm.

Piceous ; prothorax, apex of elytra, and apical joints of antennæ brown ; underside (except apex of venter), marginal channels of elytra, and palpi ferruginous ; basal joints of antennæ, legs, and a vaguely defined elongate spot on the basal half of each elytron flavous. The spots are flavous only between striæ 2 and 6, and fade away into brown at the margins.

Head rather flat, finely and closely punctate, less closely on vertex, frontal foveæ shallow, eyes rather flat, antennæ submoniliform, mentum with an obtuse tooth. *Prothorax* moderately convex, subquadrate, a fifth wider than head, a fourth wider than long, base much wider than apex, sides strongly rounded near front angles, which are a little removed from neck, thence nearly straight (though actually faintly sinuate) to base, hind angles slightly obtuse but hardly rounded and a little reflexed, hind seta on the angle, front one at apical fourth ; median line fine, transverse basal depression faint, basal foveæ small but moderately deep, surface finely and closely punctate. *Elytra* rather flat, elongate-oval, truncate at apex, nearly twice as wide as prothorax, a half longer than wide, basal border hardly extending beyond stria 4 though continued as a fine line inwards ; striæ moderately deep, finely and a little irregularly punctate, intervals slightly convex, 3 with three pores, 7 with 4 to 6 pores

adjoining stria 6, marginal series inconspicuous and interrupted, each interval with an irregular row of minute pores down the middle. Microsculpture of the elytra isodiametric; none visible on head or prothorax. Underside sparsely pubescent; last dorsal and ventral segments as in *eremnus* (♀); claws each with four short teeth, extending only over the median third, and increasing slightly in length from base towards apex.

UNITED PROVINCES: Ranikhet, 1 ex., and West Almora, 2 ex. (all *H. G. Champion*). The type is in the British Museum.

I have described this species as a *Dromius* with some hesitation, not only on account of the short obtuse tooth in the mentum, normally foreign to the genus, but also because a punctate head and prothorax are at all events unusual. In other respects, and particularly in the seriate-punctate seventh interval of the elytra, the new species presents the normal generic characters, and while so many small Himalayan species of *Lebiini* remain to be described I have thought it best not to propose a new genus.

Dromius sphex, sp. n.

Length 3.5 mm.

Flavous; disk of prothorax and underside mainly piceous, but sometimes ferruginous, apical joints of antennæ brown, head and an elytral band black, the band placed a little behind middle and occupying about half the area, extending slightly both forwards and backwards along suture and along margins, sometimes nearly reaching base along interval 1.

Head convex, frontal foveæ small but moderately deep, eyes not prominent, antennæ submoniliform towards apex, surface impunctate. *Prothorax* moderately convex, cordate, a fifth wider than head, a third wider than long, front angles rounded, at a little distance from neck, sides rounded in front, gently sinuate and a little explanate behind, hind angles rectangular in plan, but a little rounded and reflexed, both setæ on the border just in front of the hind angle and at about apical third; median line, hind transverse impression, and basal foveæ all moderately deep, the foveæ continued forward on each

side as a fine line parallel with sides, surface impunctate, a little uneven near the hind angles, an impression on each side of disk rather before middle. *Elytra* convex, ovate, but truncate at apex, three-fourths wider than prothorax, a little more than a fourth longer than wide, basal border reaching a point opposite stria 4; striae hardly impressed, but represented on the pale area by underlying pores which just break the surface here and there, a single pore on the site of interval 3 quite close to apex, marginal series formed by few but large pores. Microsculpture of the head and elytra formed by well-defined isodiametric meshes; on the prothorax the meshes are smaller, rather less distinct, and on average a little wider than long. Last dorsal segment deeply emarginate on each side; venter glabrous, apical segment ♂ with one marginal seta, ♀ with two setae on each side; claws each with four small teeth.

PUNJAB: Simla Hills, Theog, 7000 feet (*S. N. Chatterjee*), 1 ex., "in moss," and Fagu, 8000 feet (*M. Cameron*), 1 ex., both Forest Research Inst. UNITED PROVINCES: Sijla Gad, 5000 feet (*S. N. Chatterjee*—Forest Res. Inst.), 2 ex.; West Almora (*H. G. Champion*), 1 ex. Type (Theog) in the British Museum.

Very similar both in size and colour to *D. bifasciatus* Dej. from Western Europe, but in that species there is a large black triangular patch over the base of the elytra, the prothorax is narrower and its microsculpture coarser, the elytral striae are evident, and the basal border extends further inwards.

Var. *ingens*, nov.

Length 5 mm.

Apart from the much larger size there are slight differences in the elytral pattern, the black area extending forward along interval 1 and extending into a patch four intervals wide on each side around the scutellum, while a small piceous spot is also present on each side below the shoulder, so that in pattern it approaches more nearly to *bifasciatus*. The head and prothorax are almost exactly similar, but the sides of the latter are reflexed. The elytra are rather flatter, the elytra visibly though very lightly striate, as in *bifasciatus*, the under-

lying pores mostly dark and consequently far more conspicuous.

In other respects the variety is so remarkably like the type-form that I hardly like on a single example to describe it as a new species.

UNITED PROVINCES : Mussoorie, Dhobi Ghat (*M. Bose*), 1 ex., ♀. The type is in the British Museum.

STILBOMA, gen. nov.

Very nearly allied to *Pericalus*, but on a much smaller scale. *Head* unusually large, eyes large but not hemispherical (as in *Pericalus*), adjoining buccal fissure, antennæ moniliform, pubescent from joint 4, labrum much longer than wide, rounded in front, not emarginate, sexsetose, the two outer setæ placed at some little distance from the four inner ones, clypeus bisetose, a little emarginate, ligula narrow, dilated at apex, which is quadrisetose, paraglossæ free, as wide as ligula, curving inwards and extending far beyond it, mentum edentate, maxillary palpi with the last joint a half longer than the penultimate, labials with the penultimate bisetose and as long as the apical joint. *Prothorax* subquadrate, strongly transverse. *Elytra* rather flat, subquadrate, but truncate at apex, the basal border entire. Protarsi ♂ with the three basal joints slightly dilated and clothed beneath with whitish scales, joint 4 entire, claws denticulate.

Genotype, *Stilboma smaragdus*, sp. n.

Stilboma smaragdus, sp. n.

Length 5 mm. ; width 2 mm.

Piceous beneath, upper surface bright green, the head and prothorax with a faint bluish tinge, the elytra brighter near apex ; palpi, antennæ, and legs ferruginous, femora slightly infuscate.

Body winged. *Head* large, rather flat, eyes fairly prominent, labrum and clypeus nearly smooth, clypeal suture distinct, no frontal foveæ, antennæ extending a little beyond base of elytra, surface between the eyes densely longitudinally striate, the striæ subcrenulate and anastomosing. *Prothorax* moderately convex, as wide as head, nearly two-thirds wider than long, widest close to apex, base somewhat produced at middle,

its sides oblique, a little narrower than apex, sides gradually contracting behind, nearly straight to the hind angles, obtuse and a little reflexed, but hardly rounded, hind seta just within the angle, front one at a fourth from apex, the outline bulging a little outwards at both points; median line very fine, transverse impressions slight, basal foveæ absent, surface densely and rather irregularly strigose. *Elytra* rather flat, slightly compressed at sides, less than a half wider than prothorax, about a half longer than wide, base emarginate at middle, sides parallel, the apical truncature on each side slightly emarginate, outwardly rounded, no mucro at apex; striæ moderately impressed and finely crenulate, a fairly long scutellary stria present, intervals slightly convex, 3 with a large pore at basal third occupying the whole interval, and another close to apex with a small tubercle just before, and another one just behind it, surface with traces of minute puncturation. Microsculpture of the elytra formed by very coarse transverse lines which anastomose here and there but hardly form meshes; hardly any is visible on the head and prothorax owing to their rough surface. Underside shiny, impunctate, last ventral segment (♂) slightly emarginate, with a single marginal seta on each side; each claw with three small teeth towards apex.

JAVA, 1 ex., ♂, in the British Museum (type). SUMATRA: Siantar, Simpang Raja (*J. B. Corporaal*-Amsterdam Museum), 1 ex., ♂.

Stilboma viridis, sp. n.

Length 4.6 mm.; width 1.9 mm.

A rather smaller insect than *S. smaragdus*, of a brighter green, the head and prothorax without any bluish tinge, the antennæ and palpi a little paler, the legs flavous. Head not so wide, eyes less prominent, clypeus subrugose, depressed in front, the surface finely vermiculate. Prothorax slightly, though evidently, wider than head, of similar shape, the surface finely and densely vermiculate. *Elytra* of similar shape, but more deeply striate, so that the intervals are more convex. Microsculpture similar but finer.

SUMATRA, 1 ex., ♂, in the Deutsch. Ent. Museum, Berlin—Dahlem.

Amblystomus luticeps, sp. n.

Length 3.75-4 mm.

Black; apex of palpi, joint 1 of antennæ, and legs ferruginous.

Head wide and massive, frontal foveæ obsolete, labrum and clypeus both asymmetrical and rather deeply emarginate, the basal membrane of the former exposed, clypeal suture irregular but distinct, eyes not prominent, antennæ extending a little way beyond base of elytra. *Prothorax* convex, subquadrate, a fifth wider than head, a half wider than long, widest at apical third, base as wide as apex, sides rounded, without sinuation behind, hind angles evident though obtuse and rounded; median line just visible on disk, though impressed at the ends of the visible portion, hind transverse impression rather slight, the foveæ obsolete, basal area finely punctate. *Elytra* moderately convex, rather less than a half wider than prothorax, two-fifths longer than wide, feebly dilated behind and widest at about apical third, shoulders square, apex subtruncate; striæ vaguely crenulate, moderately impressed on disk, lightly at sides, but all visible to apex, the punctures of the marginal series very large but widely interrupted at middle; intervals nearly flat, 1 narrowed and raised behind, a single dorsal pore on 3, adjoining stria 2. The microsculpture of the prothorax and elytra consists of very fine transverse lines which form very wide meshes; on the head the meshes are isodiametric. Metasternal process bordered, metepisterna twice as long as wide; venter with traces only of fine pubescence; tarsal joint 5 with a pair of setæ beneath.

SUMATRA: Deli, Gunungrinteh, Medan, Bindjai, Negri Baru, Bungamas, Mana, Palembang. JAVA. The type is in my collection; co-types in the collections of Mr. B. H. Klynstra and Mr. C. J. Louwerens, in the Museums of Amsterdam, Leiden, Dresden, Genoa, and Stockholm, and in the Deutsch. Ent. Museum at Dahlem.

Until I had seen the type of *A. quadriguttatus* Motch. I took this to be an unspotted variety of it, but I now find it to be distinct. Compared with Motchulsky's species the size is rather greater, there are, as a rule, no spots on the elytra, and the second joint of the antennæ

is dark. In addition the labrum and clypeus are both more asymmetrical and more emarginate, the base of the prothorax is less depressed but more evidently punctate, and the outer striæ of the elytra, though lightly impressed, much more distinct.

Among the specimens from Medan there are in the Amsterdam and Stockholm Museums examples with yellowish spots on the elytra, sometimes with an apical spot only, and sometimes with a shoulder-spot as well. These spots, however, are small and round, unlike those of *quadriguttatus*, and as in other respects the specimens resemble *laticeps*, I treat them as varieties of that species.

Bembidion psilodorum, sp. n.

Length 4.5-4.75 mm.

Black; head, prothorax, and sometimes elytra with greenish reflections; joints 1 and 2 of antennæ, with basal half of joints 3 and 4, tibiæ, and tarsi flavous; rest of antennæ, penultimate joint of palpi, and generally basal two-thirds of femora fuscous; elytra each with a vague dark red humeral and sometimes also an apical spot (both present in the type and joined along interval 6).

Head with fairly deep, rather smooth, parallel furrows, extending on to clypeus, eyes flat, antennæ reaching basal fourth of elytra, one or two fine punctures at sides of vertex. *Prothorax* convex, cordate, a fourth wider than head, only a sixth wider than long, base a shade wider than apex, sides rounded in front and sinuate at about a fourth from base, hind angles sharply rectangular, with a well-developed carina; median line very fine, front transverse impression quite distinct and bearing a few fine punctures, hind one and basal foveæ fairly deep, basal area finely and fairly closely punctate. *Elytra* convex, ovate, nearly two-thirds wider than prothorax, a half longer than wide, shoulders square, border reaching stria 5; rather lightly punctate-striate, 1 deep to apex, the rest evanescent from about middle, but the very fine punctures on all just visible practically to apex, 8 deep behind, joining marginal channel behind shoulder, the outer striæ except close to base formed by the punctures, apical stria and scutellary striae both present, but rather slight; intervals nearly flat, dorsal pores adjoining stria 3. No visible microsculpture. Metasternal process bordered.

KASHMIR: Lidar Valley, Pahlgam, 7000 feet, 7. vi. 1928, Frislina, 8000 feet, 11. vi. 1928 (both *C. F. C. Beeson*), and Lidarwat, 9000 feet, 12. vi. 1928 (*B. M. Bhatia*); Jhelum Valley, Gulmarg, 8500 feet, 4. vi. 1928 (*C. F. C. Beeson*).

The type is in the British Museum; co-types in the Forest Research Institute, Dehra Dun, and in my collection.

XLVIII.—*Two new Species of the Nematode Genus Mermis.*

By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

IN this paper some account is given of two species of *Mermis* which present considerable similarities, although they came from widely separated localities. The first species dealt with is a West African form, the second is European, having been found in France. The majority of the Mermithidæ that are collected are immature forms which have just emerged from their insect hosts, and at this stage it is rarely possible to identify them with any known adult form. It is very desirable that when adult forms are met with they should be described, so that it may be possible to recognize them in the future, and possibly to correlate them with their larval forms. Even in Europe only a restricted number of adult forms have been adequately described. The writer has been able to find descriptions of only five species of Mermithidæ from the continent of Africa, and only one of these (*Mermis damarensis* Steiner, 1916) is an adult form.

I.

Mermis tamalensis, sp. n. (Figs. 1-5.)

In July 1932 Dr. N. A. Dyce-Sharp, of the West African Medical Service, sent home to England some specimens of a worm which had been found by a native soldier in dry soil, at a depth of 5 inches from the surface, at Tamale, Gold Coast. As originally found the worms formed a small mass consisting of one female and sixteen males. The female worm and two of the males were sent to Dr. P. H. Manson-Bahr, D.S.O.,

and one male was sent to Dr. C. M. Wenyon, C.M.G., F.R.S. Through the kindness of these gentlemen the writer has had the opportunity of examining all the four specimens, which prove to be all of the same species. As it has not been possible to find a description which fits them, it is thought desirable to describe them as representing a new species.

The males measure 17.5, 23, and 30 mm. in length and 0.16, 0.17, and 0.22 mm. in maximum thickness respectively. The female measures about 167 mm. in length and 0.43 mm. in maximum thickness. The diameter of the head in the males is 0.06–0.07 mm. in dorso-ventral view and 0.05–0.06 mm. in lateral view. In the female it is 0.09 mm. and 0.08 mm. respectively.

Fig. 1.

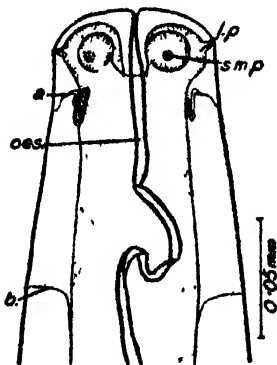
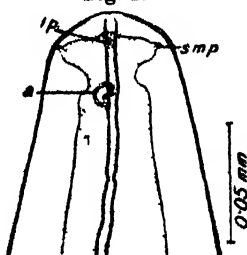


Fig. 2.



Mermis tamalensis, sp. n.

Fig. 1.—Anterior end of male; dorso-ventral view. *a.*, *b.*, cervical nerve-endings; *l.p.*, lateral papilla; *oes.*, oesophageal tube; *s.m.p.*, submedian papilla.

Fig. 2.—Anterior end of male; lateral view. *a.*, cervical nerve-ending; *l.p.*, lateral papilla; *s.m.p.*, submedian papilla.

The head is thus seen to be somewhat dorso-ventrally compressed. As seen in dorso-ventral view (fig. 1) the "pulp" of the head is deeply excised in the middle line, forming two lateral lobes, each of which is again divided by slight constrictions into three portions. The middle portion of each lobe bears a lateral papilla,

Fig. 3.

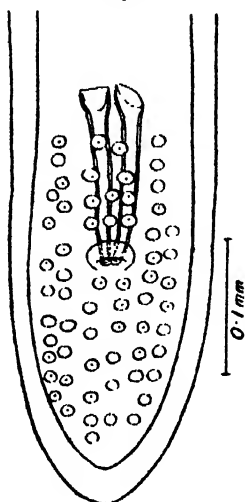


Fig. 4.

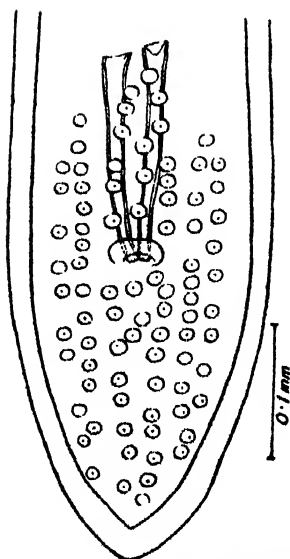
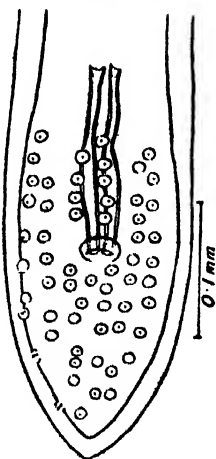


Fig. 5.



Mermis tamalensis, sp. n.

Posterior ends of three males; ventral view.

while the four submedian (two subdorsal and two sub-ventral) papillæ are each situated on one of the smaller portions. The mouth is a minute, laterally compressed opening leading into an œsophagus, which is, as usual in this group, reduced in the adult to a mere cuticular tube. The length of this tube could not be determined. The nerve-ring was not made out, and no excretory pore was observed in any of the specimens. Situated laterally, close behind the head, there is a pair of curious organs (figs. 1 & 2, *a*) which resemble narrow, coiled tubes with extremely fine ducts leading to the surface of the cuticle. At their proximal ends these "tubes" are lost sight of in the general parenchyma of the body-wall. It seems uncertain whether these organs represent the "lateral organs" usually present in Mermithidæ (of which otherwise no trace could be found), or whether they are simply special nerve-endings and represent a pair of cervical papillæ. The latter seems the more probable, since organs rather similar to these (the "Kanalfaser" of German authors) have been described in other species in addition to lateral organs of a more typical kind, and since a second pair of extremely fine lateral nerve-terminations can be seen further back in the present specimens (fig. 1, *b*).

The posterior end of the male is somewhat compressed dorso-ventrally and concave on the ventral surface. The tails of the three males measure respectively 0.155, 0.18, and 0.225 mm. in length, being in each case proportional to the total size of the worm. The ventral surface bears numerous rather large caudal papillæ, which may be regarded as forming three double longitudinal rows, though their arrangement shows some variation, as does also their number. In one specimen (fig. 3) there are 63 papillæ, almost symmetrically placed. The double row in the mid-ventral line tends to break up immediately in front of and behind the cloacal aperture (figs. 3, 4 & 5) so as to form three rows. The second specimen (fig. 4) shows a somewhat less regular arrangement of the papillæ, of which there are altogether 85, while in the third specimen (fig. 5) the papillæ number only 60 and are still more irregularly arranged. The spicules vary in length from 0.15 to 0.18 mm. They are tubular and rather stout, measuring about 0.025 mm. in

diameter at the roots and tapering gradually to the very blunt tips.

The vulva of the female is situated considerably in front of the middle of the body, at about 73 mm. from the anterior extremity. The vagina is stout and muscular, takes the form of a very elongate S, and runs posteriorly for a distance of about 0.6 mm. from the vulva. The eggs *in utero* are thin-shelled and apparently lenticular in shape, measuring about $0.045 \times 0.035 \times 0.025$ mm. No polar filaments were observed on them.

In the arrangement of the caudal papillæ of the male this species closely resembles the European forms *Mermis brevis* Hagmeier, 1912, and *M. albicans* v. Siebold, 1848. *M. brevis*, however, is a much smaller species, not exceeding 35 mm. in length, while the structure of the head in both these species shows considerable differences from that here described.

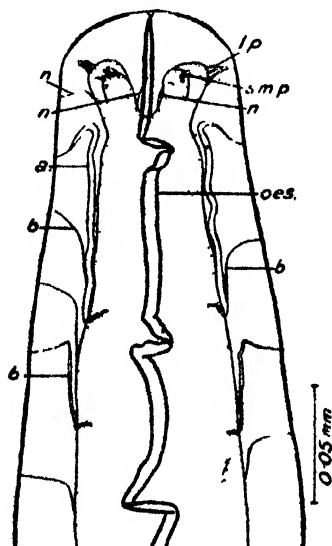
II.

M. R. Pussard, of the Station Entomologique, St.-Genis-Laval, near Lyons, France, discovered in July 1931 in the adults of *Psylla alni*, *P. försteri* and *P. viburni* some larval Mermithidæ which he was good enough to send to the writer for examination. M. Pussard (1932) has himself placed his discovery on record, and noted that in female Psyllids the parasite causes the destruction of the ovaries and fat-body. It has not been possible to determine the species to which these larvæ belong. Of the two complete specimens examined by the writer one measured about 22 mm. in length and 0.19 mm. in maximum thickness, the other about 30 mm. and 0.24 mm. respectively. Each had a bluntly rounded tail, provided with a tapering caudal appendage or "horn" about 0.08 mm. long. The fat-body still occupied almost the whole of the body-cavity, and the adult characters had not yet been developed.

Wishing to discover whether the adult form could be found in the soil under the trees on which the Psyllids occurred, M. Pussard, during the following winter, undertook digging operations at this spot (Crémieu, near Lyons). His search resulted in the finding of three

Mernithids, which were forwarded to the writer. Unfortunately it proved impossible to identify them with the larval form from *Psylla*. The three specimens included at least two species, and comprised two males and an immature, moulting female. One of the males was determined by the writer as *Mermis elegans* Hagmeier, 1912. The other could not be identified with any known species, and is described below. It was impossible to find sufficient characters in the female to determine

Fig. 6.



Mermis pussardi, sp. n. Anterior end of male; dorso-ventral view.

a., b., cervical nerve-endings; l.p., lateral papilla; n., n., isolated cephalic nerve-endings; oes., oesophageal tube; s.m.p., submedian papilla.

whether it belonged to the same species as either of the males. It measured about 115 mm. in length and 0.28 mm. in maximum thickness, and the vulva was situated at about 51 mm. from the anterior extremity.

Mermis pussardi, sp. n. (Figs. 6-8.)

The single male specimen of this species available measures about 43 mm. in length and 0.2 mm. in

maximum thickness. The head, at the level of the cephalic papillæ, has a diameter of 0.065 mm. in lateral view and of 0.075 mm. in dorso-ventral view. It thus appears to be somewhat dorso-ventrally compressed. The shape of the "pulp" of the head (figs. 6 & 7) is very similar to that described for *M. tamalensis*, there being deep indentations in the mid-dorsal and mid-ventral lines, dividing the pulp into two main lateral

Fig 7

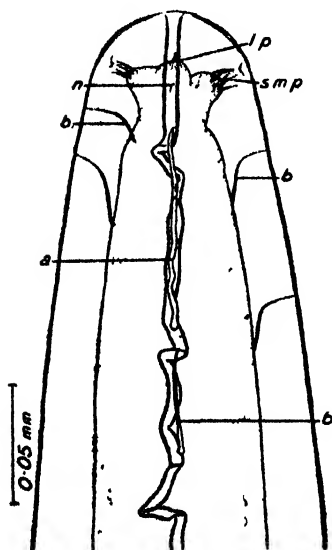
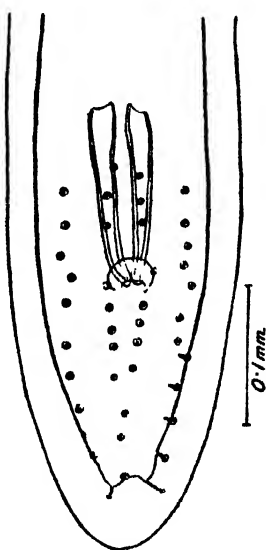


Fig 8.



Mermis pussardi, sp. n.

Fig. 7.—Anterior end of male; lateral view. *a.*, *b.*, cervical nerve-endings; *l.p.*, lateral papilla; *n.*, isolated cephalic nerve-ending; *s.m.p.*, submedian papilla.

Fig. 8.—Posterior end of male; ventral view.

lobes, which are themselves somewhat trilobate. The two lateral and four submedian papillæ seem to consist each of several fine, thread-like nerve-endings. In addition several fine, isolated nerve-endings spring from the bases of the lobes of the pulp (figs. 6 & 7, *n.*). The mouth is laterally compressed and leads into a narrow cuticular

tube (the œsophagus) of uncertain length. This tube is surrounded by the nerve-ring at a distance of 0.32 mm. from the anterior extremity.

At the sides, a little behind the lobes of the head, there is a pair of organs (figs. 6 & 7, *a.*) resembling narrow tubes. These clearly correspond with the similar organs in *M. tamalensis*, but in the present species they are not coiled, and run almost straight back for some distance before being lost in the parenchyma of the body-wall. Their distal terminations are extremely fine and thread-like. In addition to these there are several other very fine nerve-terminations (figs. 6 & 7, *b.*) in the cervical region. Some of these are lateral, some dorsal, and some ventral, and they do not appear to be always symmetrically arranged in pairs.

The tail (fig. 8) measures about 0.21 mm. in length and is bluntly rounded. Altogether 42 caudal papillæ have been made out; the general arrangement of these is in four longitudinal rows, two lateral and two submedian. The submedian rows become a single median row at the posterior end. The spicules are similar in form to those of *M. tamalensis*, and measure about 0.18 mm. in length. Their greatest dorso-ventral diameter, near the roots, is about 0.02 mm.

This species appears to be fairly closely related to *M. terricola* Hagmeier, 1912, but the male of *M. terricola* is smaller and has longer spicules (0.25 mm.) and more numerous caudal papillæ, a median row of these extending for a considerable distance in front of the cloaca. *M. terricola* also possesses a pair of goblet-shaped lateral organs, which seem to be absent in *M. pussardi*.

REFERENCES.

- HAGMEIER, A. 1912. "Beiträge zur Kenntnis der Mermithiden." Zool. Jahrb., Syst. xxxii. pp. 521-612, pls. xvii.-xxi.
 PUSSARD, R. 1932. "Sur un Nématode parasite de Psyllides." Compt. rend. Acad. Sci. Paris, cxcliv. p. 493.
 STEINER, G. 1916. "Nematodes," in Michaelsen, W., Beiträge zur Kenntnis der Land- und Süßwasserfauna Deutsch-Südwestafrikas, Hamburg, i. 4, pp. 377-411.
 ——. 1921. "Beiträge zur Kenntnis der Mermithiden." Centralbl. f. Bakt. &c., 1 Abt. Orig. lxxxvii. pp. 451-465.

OBITUARY NOTICE.

LT.-COL. JOHN STEPHENSON, C.I.E., F.R.S.

LT.-COL. STEPHENSON became one of the joint editors of this Magazine in January 1928. Volumes subsequent to that in which this notice appears must bear another name in place of his. Heart trouble, of old standing, brought the inevitable end on 2nd February last, only a few days after he had been discussing papers submitted for publication in these pages.

Stephenson was one of the many distinguished zoologists produced by the Indian Medical Service. He was born at Padiham, in Lancashire, in 1871, and studied at the University of Manchester, where he graduated in Science and Medicine. He was appointed to the Indian Medical Service in 1895, and saw active service on the North-West Frontier Expedition of 1897. After an experience of plague duty he served as civil surgeon at various stations till 1906, when he was appointed Professor of Biology in the Government College at Lahore. Six years later he was made Principal of the College and later still he became Vice-Chancellor of the University of the Punjab.

Stephenson had studied Zoology at Manchester under Milnes Marshall, and at Lahore he set himself with energy to the task of organising a school of Zoology. He succeeded in imparting his own enthusiasm for the subject to some, at least, of his Indian students, and several of them have attained distinction in various branches of the science. In 1920 he retired from India and settled in Edinburgh, where he was appointed Lecturer in Zoology in the University and took an active part in teaching and research in the department directed by Prof. Ashworth. In 1928 he removed to London, becoming an "unofficial worker" in the Natural History Museum and editing the 'Fauna of British India' series of monographs for the India Office. In 1931 he became Zoological Secretary of the Linnean Society, and he was a member of many committees, including the International Commission on Zoological Nomenclature. He was elected a Fellow of the Royal Society in 1930.

Stephenson's own work was mainly devoted to the Oligochaeta, on which he published a long series of memoirs from 1907 onwards. Beginning with the Indian species, he later

extended his researches to those of other regions and prepared a comprehensive treatise on the group, 'The Oligochaeta,' published in 1930 by the Clarendon Press. In this book he gave a masterly summary of existing knowledge and discussed with much originality and breadth of view the problems of morphology, phylogeny, and geographical distribution presented by this group of animals.

Stephenson, however, was no narrow specialist. He had an unusually wide knowledge of biology, in both its descriptive and its interpretative aspects. Perhaps the best of his knowledge and judgment was modestly hidden in the work of the younger zoologists whose researches he directed and whose writings he edited.

One of Stephenson's recreations was the study of Arabic and Persian literature. He published translations of two old Persian works, one a 14th century treatise on Natural History.

Stephenson had a particularly charming and attractive personality. A friend of his later years may be permitted to bear testimony to the gallantry and even gaiety with which he lived, under what must have been, to a medical man, the ever-present consciousness of the impending sword.

W. T. C.

BIBLIOGRAPHICAL NOTICE.

Australian Finches in Bush and Aviary. By NEVILLE W. CAYLEY. The Australian Book Co., 16 Farringdon Avenue, London, E.C. 4. Price 12s. 6d.

How nice to find a book with modern, scientifically accurate nomenclature written by a man who has studied his subject.

This book will attract readers, as did the author's former work 'What Bird is that?'

The volume is divided in a useful way, the reference being given to the genus and its type. The birds are described and the measurements given; the distribution and the history of bird; then the field-notes; followed by a map showing its distribution, which is most helpful; then we are given the aviary notes.

The photos of nests and immature add to the value of the work, and the delightful coloured plates make the volume all that is required by the seeker after knowledge.

This work should be on the shelves of those interested in finches, both in the field and in the aviary. G. M. M.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 64. APRIL 1933.

XLIX.—*Principles in the Classification of the Spiriferidæ.*
By T. NEVILLE GEORGE, D.Sc., Ph.D., F.G.S.

CONTENTS.

	Page
I. Introduction	423
II. The older Classifications	425
III. Recent Classifications	427
IV. The Contribution of Buckman	435
V. The Morphogeny of Spiriferoid Biocharacters	436
(i.) The Cardinal Development.	
(ii.) Costation.	
(iii.) Plication.	
(iv.) Minor Ornament.	
(v.) Internal Plates.	
VI. Conclusion	453

I. INTRODUCTION.

The period of relative stagnation that followed upon the pioneer work of Davidson, Waagen, Hall & Clarke, and Schuchert in the study of the Spiriferacea has given place during the past decade to a revival of interest in the group—in particular, there have been very considerable advances in knowledge of the morphology of the various forms. This has resulted in the erection of a number of new genera, and has led to new groupings of the genera into different families and subfamilies. In some cases the classifications adopted have differed singularly little

from those of earlier writers ; while in other cases there have been wide departures, by the introduction of new criteria, from the old-time groupings. But whereas the increase in morphological knowledge has been enormous, the accompanying theoretical considerations have not shown a corresponding elasticity in point-of-view, and indeed have failed to assimilate the wealth of facts accruing from observation. The congestion is particularly noticeable in the classifications of various systematists, most of whom seem to have accepted naively one scheme or another, or to have extracted fragments of various schemes ; and although the foundations of the schemes are intrinsically present in, and not difficult to extract from, the systematic descriptions, they are rarely explicitly stated.

The present paper is an attempt to analyse the various methods adopted in the classification of the spirifers, to indicate the bases upon which they are built, and to demonstrate inconsistencies and incompatibilities when such occur. As its title implies, it is not in any sense exhaustive ; nor is it conceived primarily as a means of propounding a new classification to replace or supplement those now existing. Classification, being essentially a subjective co-ordination, largely depends upon the needs and the end-in-view of the systematist, and no single system may inherently command acceptance at the discard of others. No more can be claimed than that with a particular end desired one system may embrace more relevant facts within its purview than another, and may thus more richly and profoundly unite those facts into a completer whole. But when the ends are different, the systems may well be different. Nevertheless, while all systems presumably conform to some ideal, none being intrinsically more "natural" than another, yet the taxonomic results of these different systems are superficially the same—the establishment of species, genera, and families. It is therefore apparent that a particular genus, a necessary creation of one system, may be meaningless and unplaceable in another system. It follows that the principles of classification should be rationally founded and expressly recognized before the creation of new and inviolable names is carried out. Conversely, the frequent relegation to synonymy,

characteristic of revisions, may largely be due to the imposition of some extraneous system upon a classification devised upon a different plan.

II. THE OLDER CLASSIFICATIONS.

It is unnecessary, in view of the historical work of Davidson (vol. i. 1851, p. 41), Hall & Clarke (1894, p. 7), Paeckelmann (1931, p. 5), and others, to consider in very great detail the methods of the earlier investigators, and a brief *résumé* must suffice. In large measure, the groupings were frankly based on the more conspicuous features of ornament and shape. Thus Phillips (1836, p. 216) at a very early date recognized six divisions, that he described in terms of :

- (1) The development of the ventral cardinal area.
- (2) The length of the hinge-line.
- (3) The characters of the surface-ornament.

To each of his divisions he gave what may be called family names, though they were all comprised within the genus *Spirifer*. Contemporaneously with Phillips, von Buch (1837) propounded a less elaborate, but essentially similar, classification founded upon the differentiating characters of :

- (1) The length of the hinge-line.
- (2) The ornament of the sulcus in the ventral valve.

These two first attempts have had a profound effect upon most subsequent work—the former in Britain, the latter more particularly on the Continent. No radical modifications were made for nearly half a century, until Waagen revised the group in 1883. Thus M'Coy (1844, p. 127) in effect adopted the groupings of Phillips, but endowed each with a separate generic name or names: the Angustatæ remained *Spirifer*, the Radiatæ became *Brachythyris*, the Glabratae *Martinia* and *Reticularia*, while he introduced Dalman's genus *Cyrtia* for the Cuspidatæ. Davidson, conservative-minded, refused to accept M'Coy's genera until the close of his life, and had much to do with delaying progress in systematic work. By 1882 (vol. v. p. 80), however, he was prepared to divide the Spiriferidæ into four groups, corresponding approximately with the original

groups of Phillips. Most of Davidson's contemporaries, as Tryon (1882, p. 320), Zittel (1880, p. 681), and Etheridge (1888, p. 263), followed him in regarding *Spirifer* as the protean genus of Sowerby, including within it *Delthyris*, *Choristites*, *Trigonotreta*, *Martinia*, *Brachythyris*, *Fusella*, and *Reticularia*.

Waagen (1883, p. 497) made a great step forward when he introduced several new criteria and elaborated those already employed. He divided the Spiriferidæ into four subfamilies, basing his distinctions upon four sets of characteristics :

- (1) The development of the spiralia, particularly the development of the jugal structure.
- (2) The development of internal lamellæ.
- (3) The type of external surface-ornament.
- (4) The width of the cardinal area.

His classification serves admirably to illustrate the essentially morphological view-point of these earlier workers—a view-point that displayed each species and each genus as a static entity possessed of certain fixed characters by which it could be identified ; the recurrence of similar characters amongst different genera enabled the larger groupings to be effected. In fundamentals, the classification differs not at all from the superficial distinctions of Phillips and von Buch ; it merely makes the distinctions more comprehensive and more detailed by the examination of a larger number of biocharacters, amongst which are introduced considerations of internal structure. The latter criteria were much emphasized, and it is evident that Waagen and his contemporaries laid much greater weight upon them for their divisions than upon the more obvious, but supposedly less fundamental, features of external ornament and shape. Thus Waagen (*ibid.* p. 529) regarded the distinction between *Martinia* and *Spirifer* proper—the absence of costate ornament in the former—to be merely of practical value, which could happily be supplemented by the truly scientific criterion of the internal plates of the ventral valve of *Spirifer*.

Hall and Clarke (1894, p. 10) accepted the broad outlines of Waagen's scheme, laying particular emphasis upon internal characters: "Such changes . . . which we recognize as having induced actual generic differences

are confined to the interior and the intimate structure of the valves; external variations, as far as known, when unaccompanied by internal changes, must be regarded as of altogether subordinate value." On the other hand: "These external differences, however, make an excellent basis for a grouping of the members of this protean genus, and one not merely conventional and arbitrary, since it serves to indicate, within the integrity of the genus, lines of progress leading to resultants which are no longer congeneric." They followed these observations with a complicated system of classification, in which the Spiriferidæ are divided into six main groups, essentially similar to the groups of Phillips and von Buch, and based for the greater part upon external characters—thus vitiating in practice their previous remarks on theory. The internal features were more generally employed to distinguish between the separate members of each of these larger groups, though the various characters were indiscriminately and inconstantly used.

Schuchert (1897, p. 127) virtually returned to the classification of Waagen, but introduced some new conceptions concerning the value of classificatory divisions: "No division has any value unless the group contains forms of but one phylum. A phylum, or line of descent, cannot originate twice. It happens, however, that the same or nearly the same combination of mature characters is developed along different phyla It is not correct to group these different stocks as belonging to one family"—a remark that was destined to bring forth rich fruit a few years later at the hands of Buckman. Schuchert, however, does not appear to have applied his principle very generally, or at all to the Spiriferidæ.

During the first decade or so of the present century, there were several modifications of the morphological schemes of Waagen and Hall & Clarke—as, for example, by Scupin (1900), Girty (1908, p. 339), and Schuchert (1913, p. 410), none of whom, however, introduced any fundamental change in the point-of-view.

III. RECENT CLASSIFICATIONS.

Three important classifications, introduced or developed during the past decade, demand special attention—those of Frederiks, Schuchert & LeVene, and Paetzelmann.

Frederiks, in a series of papers (see, in particular, 1926, p. 393; 1927, p. 1), has examined in minute detail the various internal structures that occur in the umbonal region of spiriferoid valves, and has propounded an elaborate terminology for them. Using each of these structural grades as his main divisions, he has grouped the members of a comprehensive family Spiriferidæ into the following eight subfamilies:—

- (1) Martiniinæ.—Aseptate. *Martinia*, *Ambocælia*, *Squamularia*.
- (2) Brachythyriinæ.—Apical plates incipiently developed in the ventral valve. *Brachythyris*, *Anelasma*.
- (3) Munellinæ.—Apical plates cross the umbo of the ventral valve. *Martiniopsis*, *Eoreticularia*, *Reticulariopsis*.
- (4) Elythinæ.—Apical plates strongly developed; slight development of a median septum (euseptoid). *Spirifer*, *Elytha*, *Spirelytha*, *Eospirifer*.
- (5) Delthyriinæ.—Apical plates and median septum (euseptum) strongly developed. *Delthyris*, *Reticularia*, *Spiriferella*.
- (6) Cyrtiinæ.—Apical plates and delthyrial lamella (the "ostiolate" stage). *Cyrtia*, *Cyrtella*, *Spinocyrtia*.
- (7) Syringothyriinæ.—Apical plates, delthyrial lamella, and syrinx. *Syringothyris*, *Cyrtina*, *Davidsonina*.
- (8) Spiriferininæ.—Apical plates, delthyrial lamella, and pseudoseptum. *Spiriferina*, *Mentzelia*.

His method of analysis is thus extremely simple, and is readily applicable when the internal structures are adequately known. Furthermore, Frederiks must be credited with a lucid presentation of his views, and with the practical application without modification of his theoretical opinions. The lesser divisions (the genera) within these subfamilies are separated from one another on the characters of their external ornament in precisely the same fashion: some seven or eight different grades, such as glabrous, plicate, spinous, plicato-lamello-fimbriate, are recognized, each of which serves as a convenient criterion. Assuming the reality of the separateness of these grades—sometimes difficult,—their application is as readily effected as in the case of the subfamily divisions. The whole system thus results in a reticulum

or lattice-work, of which the ordinates are the development of internal plates and the type of surface-ornament. Any particular genus is referred to its appropriate pigeon-hole solely on these fixed criteria. The complete artificiality of the scheme is demonstrated by the fact that there are several theoretically-surmised pigeon-holes (including one whole subfamily) which are not yet filled by specimens whose objective existence has been determined.

In thus confining himself to two sets of biocharacters, Frederiks has expounded a classification that has little or no superficial resemblance to any of those preceding, and his adoption of the old names, both for genera and subfamilies, is always accompanied by extensive emendations that leave them more or less greatly changed from their original meanings. In this sense, therefore, he can be said to have introduced new conceptions into the classification of the Spiriferidæ, resulting in corresponding far-reaching modifications. Nevertheless, there is not the slightest change from the view-point of Waagen and Hall & Clarke in the fundamental mode of approach. Biocharacters are regarded as fixed and static; genera are separate entities that are connected with other genera only in so far as they possess similar structures; the conception of flux and evolution is almost wholly absent from the scheme, so that when it is very occasionally introduced a certain strain of application is manifest that demonstrates its incompatibility with the morphological view-point, so that it only appears in very minor roles. Indeed, Frederiks expressly declares that, since so little is known of the evolution of the spirifers, it is essential for practical purposes that some classification such as his should be adopted, and he is well aware of the limitations of his methods.

The classification of Schuchert and LeVene (1929, p. 10) is neither so simple nor so consistent as that of Frederiks. The Spiriferidæ, from which the Spiriferinidæ (including the subfamilies Cyrtininae, Bittnerulinae, Spiriferininae, and Suessiinae) are removed, is divided into the following seven subfamilies :—

- (1) Eospiriferinae.—*Eospirifer*, *Cyrtia*.
- (2) Delthyrinae.—*Delthyris*, *Acanthospirina*.

- (3) Reticulariinae.—*Reticularia*, *Squamularia*, *Elytha*, *Spirelytha*.
- (4) Spiriferinae.—*Spirifer*, *Brachythyris*, *Cyrtella*, *Spinocyrtia*, *Spiriferella*, *Platyrachella*.
- (5) Syringothyridinae.—*Syringothyris*, *Pseudosyrinx*, *Prosyringothyris*.
- (6) Martiniinae.—*Martinia*, *Martiniopsis*, *Eoreticularia*, *Ambocœlia*.
- (7) Verneuliinae.—*Verneulia*.

It is somewhat difficult to discover the reason in every case for the allocation of the genera to their respective subfamilies, but the main criteria appear to be the following :—

- (1) External ornament. As between the Martiniinae and the Reticulariinae, and between the Eospiriferinae and the Spiriferinae.
- (2) The development or otherwise of costæ along the median plication of members of the Spiriferinae is expressly utilised for subdividing that group.
- (3) The structure of the test.
- (4) The height and degree of incurvature of the cardinal area.
- (5) The presence or absence of internal plates in the ventral valve, the relative development of those plates, and the development of accessory structures.

These criteria are not consistently employed. Thus the Syringothyridinae are apparently separated on the basis of their complicated internal structures (though the height of the cardinal area is also an important characteristic), whereas the Reticulariinae contain forms possessing a broadly uniform type of ornament, though with very different septal developments. The Martiniinae also largely consist of forms with various septal developments, but in which external ornament is for the most part absent (though *Ambocœlia* is an exception, possibly owing to its quasi-lævigata appearance). The costate spirifers are distributed between the Eospiriferinae, the Delthyridinae, and the Spiriferinae on the grounds of differences in the detailed structure of the ornament, though this criterion is not applied to the Reticulariinae, in which are grouped forms whose clathrate ornament is but crudely homœomorphic. When such latitude of

choice is permitted and when the foundations of the classification are neither expressly stated nor rigidly maintained, it becomes entirely a matter of personal predilection as to which family any particular genus is referred, and as to the validity of any particular genus. Thus, while Frederiks's scheme is, apart from minor factual errors, logically coherent, provided his basic assumptions are accepted, the same cannot be said for that of Schuchert and LeVene, and the suggestions of the latter authors that some of Frederiks's genera are ill-founded, being synonymous with ones already existing, can often only be justified on the arbitrary criteria propounded by them.

But even if the details of the classification of Schuchert and LeVene were not subject to this criticism, their mode of approach is as mechanical and static as that of Frederiks. In effect, they have advanced very little beyond the days of Waagen and Hall & Clarke, except in the degree of complication, and they still retain a mixture of more or less obvious fixed morphological characters as their guides to relationship. Under such conditions it is inevitable that the classifications propounded should depend solely upon the relative emphasis and importance laid upon the respective characters, and until observers are universally agreed upon such relative value, classifications can only be expected to differ. The differences are blatantly manifest when the classifications of Frederiks and Schuchert & LeVene are contrasted.

Similar remarks apply to certain less ambitious schemes, such as that of Leidhold (1928, p. 60, with which compare also the earlier scheme of Steinmann and Döderlein, 1890, p. 215), which is almost wholly based on the detail of the type of surface-ornament. His groups have received names that are strongly reminiscent of certain other brachiopod families, and recall the current classification of the Productidæ and (in part) Buckman's classification of the terebratuloids. A brief digression on the latter groups may be permitted.

The most recent summary of the Productidæ is that of Muir-Wood (1930), who has amplified and corrected the works of Chao, Frederiks, and Thomas. In effect, she has developed a classification essentially similar to

that of the last-named author (1914, p. 254), in which the major divisions (not separately named) are based solely on the characters of the external ornament, while the genera within these divisions are distinguished in terms of such various criteria as the shape of the shell-outline, the development of a cardinal area, the mode of life (cementation), the detail within a group possessing one broad type of ornament, and the development of internal ridges, varices, and diaphragms (analogous to the septa of the Spiriferidæ). The whole scheme is in essence remarkably similar to those of Frederiks and Schuchert & LeVene for the Spiriferidæ, though the paramount importance attaching to surface-ornament is in contrast to the minor emphasis laid upon it by Frederiks. The Productidæ, however, are classified with general unanimity in this fashion—a unanimity in marked contrast to the confusion resulting from the parallel morphological classifications of the Spiriferidæ. The reason is not far to seek. The minor characters that are employed by Muir-Wood and others for the recognition of genera are such as are not universal in the family: indeed, they are usually confined to a relatively small proportion. So that while internal septa may be employed for the limited section containing *Productus* (sensu stricto), *Dictyoclostus*, and *Eomarginifera*, it is utterly useless for the other fifteen or twenty genera, which are almost all aseptate. Similarly, only *Gigantella* and *Kansuella* possess a well-marked long hinge-line and show any development of a cardinal area. Any morphological classification that attempts to be comprehensive is thus obliged to select as its main criterion the character of superficial ornament. Amongst the spirifers, however, there is a much greater diversity of form, both internally and externally, and the confusion in classification ensues as a result of this prodigality of criteria, from which observers may select. It is interesting to note that Thomas himself, who introduced the current classification of the Productidæ into this country, considered that in the not dissimilar group of the Orthotetinae external ornament was of no value for systematic purposes, and pinned his faith almost entirely upon the development of internal septa (1910, p. 98).

Buckman (1917, p. 91), in his account of the Burmese

terebratuloids, attempted a compromise. While acknowledging his major groups, particularly the "Ornatæ" and the "Læves," to be merely morphological conveniences (essentially similar to, though less detailed than, those propounded by Thomas and Muir-Wood amongst the productids), he endeavoured to introduce some more fundamental co-ordinating factor, and discussed conceptions of evolution, genetic affinity, and homœomorphry. The result, however, was far from happy, and except in small degree his classification was morphological, with most of the defects attaching to that method. The illustration is instructive, as Paeckelmann (1931, p. 58) has adopted a comparable scheme with the spirifers.

The foundation of Paeckelmann's classification is as completely morphological as those of Frederiks and Schuchert & LeVene. His Spiriferidæ are divided between the Spiriferinæ and the Spiriferininæ, the chief means of distinction being the development of punctation and the jugal structure. These criteria are, however, not consistently maintained; thus *Syringospira* (Kindle, 1909, p. 28), an impunctate form without a jugum, is included with his third section of the Spiriferininæ, apparently on its possession of a high flat cardinal area. It is unnecessary to list his divisions in detail: it will suffice to observe that his genera (approximately equivalent in comprehensiveness to the subfamilies of Frederiks and Schuchert & LeVene) are distinguished from one another mainly on the characters of the details of their surface-ornament, if they are members of the Spiriferinæ, but on the characters of their internal septation if they are members of the Spiriferininæ. Within each large and comprehensive genus, the subgenera are mainly distinguished on a basis of internal structure. The procedure is thus largely a reversal of that of Frederiks, and is more consistently maintained than that of Schuchert and LeVene. But the results naturally are totally incompatible with those of the earlier workers, because of this different selection and emphasis: as a consequence of Paeckelmann's laudable efforts, the confusion is not resolved, it is worse confounded. But Paeckelmann adds to the tanglement in his table of descent (*ibid.* p. 58). Thus *Martinia*, a smooth form, is indicated as being descended from *Reticularia*: yet they are placed in different sections

of the subfamily. On the other hand, *Reticularia* and *Cyrtospirifer* are placed in the same section, but are shown to be quite unconnected genetically.

Sufficient has been said to indicate the trend of modern classification: despite a certain formal acknowledgment of the deductions of evolutionary theory, no real attempts are being made to express phylogenies, to distinguish between homœomorphs, and to eliminate the whimsiness of arbitrary and peculiarly personal impressions. The situation is chaotic, and, as Kozłowski aptly points out, will remain chaotic so long as each observer indulges his own fancies and builds ingenious but unconvincing classifications upon impressive rather than profound bases. The criticism is one to which morphological classification has inherently been subject since the days of the establishment of the evolutionary concept. In the first place, the groupings depend solely upon the differential characters selected, and unless the characters are truly differential (such being very rare, in fact) the groupings will not stand the test of new discovery, but will be modified and changed by each subsequent observer. And, secondly, a strictly morphological grouping largely based on progressive characters merely unites comparable stages of evolution (morphic equivalents) and takes no cognisance of the profounder bonds of relationship: it suffers, almost intentionally, from the diseases of parallel evolution and convergence.

It is true that little is known of the evolution of the spirifers: Frederiks avoids the difficulty by confessing the fact and propounding a professedly artificial scheme as the only workable alternative. But it may be suggested that ignorance is scarcely an adequate reason for imposing an extraneous scheme upon long-suffering brachiopods, and while it is not possible in every case to determine phylogeny, yet very often there is little difficulty in discovering routes along which evolution has not proceeded, and thus in distinguishing between homœomorphs; and in most instances it is possible to determine broadly the morphogeny of the ancestry, even when the individual ancestors cannot be recognized.

The remainder of the paper will consist largely of an attempt to demonstrate such lines of morphogenetic development and the various relationships they suggest.

IV. THE CONTRIBUTION OF BUCKMAN.

In the previous pages no mention has been made of the outstanding contribution of Buckman (1908) on the occurrence of homœomorphy in the spirifers. Adapting principles he had discovered and elucidated in the cephalopods and Mesozoic brachiopods, he showed the possibility of confusion involved in the application of a purely morphological classification founded upon surface-ornament, and suggested that many of the forms referred to *Martinia*, for example, were really degenerate species of *Reticularia*: "*Martinia* thus does not mark a genetic series, as it ought; but it simply denotes a stage of catagenetic development at which several different stocks of Spirifers arrive." While his conclusions are not true in fact, being vitiated by inadequate knowledge, his point-of-view is (in this instance, at least) wholly evolutionary, and he rejected without argument any simple appeal to morphology as a basis for relationship. Nevertheless, Buckman cannot be credited with making very great advance in this respect, for while he unquestioningly rejected morphological equivalence when considering ornament, he unquestioningly accepted it when considering internal septation. In fact, the evidence he employed to distinguish the (supposed) catagenic smooth *Martinia*-like species of *Reticularia* from the true *Martinia* was solely based upon the presence of apical ("dental") plates in the ventral valve: apparently it did not occur to him that these also might display the phenomena of anagenesis and catagenesis: he considered them as static and differential characters suitable for employment in such fashion.

Moreover, he increased the strength of the morphological school by adding brief diagnoses of the principal genera, in which the diagnostic characters, apart from ornament, are in almost all cases merely arbitrary stages in progressive series. These criteria were subsequently adopted without cavil, and, supported by Buckman's quasi-evolutionary professions, were considered truly differential.

Thus the ensuing remarks largely demonstrate the inaccuracy of several of Buckman's observations, and their incompatibility with a truly genetic classification.

Nevertheless, I wish to take this opportunity of acknowledging the effect of his theoretical view-point in stimulating the present conclusions.

V. THE MORPHOGENY OF SPIRIFEROID BIOCHARACTERS.

(i.) *The Cardinal Development.*

In no instance, so far as I am aware, has the protogulum been observed in the forms under consideration. The earliest ontogenetic stage preserved consists of two valves essentially similar to those of the adult, with a short straight hinge-line. Increase in size occurs by a process of mixoperipheral shell-secretion, with the development of a more or less large palintrope or cardinal area. In the majority of species the area is very small in the dorsal valve, when the growth is almost hemispherical, but as there is little change in the shape of this valve (as regards the height of the area) in the great majority of the spirifers, it may be ignored for systematic purposes. On the other hand, the area of the ventral valve varies considerably, and the umbo may be straightened out, so that the area is flat, with or without an increase in height. Thus *Spirifer carlukensis* Davidson (vol. ii. p. 59; see also George, 1931, p. 50) has an extremely small cardinal area, but its umbo is only slightly incurved. At the opposite extreme, in such forms as *Syringothyris*, *Tylothyris*, *Pseudosyrinx*, and *Spirifer distans*, the development of a plane area is accompanied by a great increase in height, and in some species it may be recurved.

Now there is little doubt that the primitive brachiopod shell-form is one in which growth is of the holoperipheral type—the type that occurs in these spiriferoids with a high cardinal area. It might seem, therefore, that the ancestral spiriferoid condition is one characterised by a syringothyroid cardinal area. On the other hand, several considerations militate against this conclusion. In the first place, the spirifers are probably evolved from primitive rhynchonelloids (Thomson, 1925, p. 430), in all of which the cardinal area is small or absent, and growth is of the mixoperipheral type. Secondly, the most primitive and earliest-known spirifers (*Eospirifer*) of the Silurian are characteristically possessed of a low incurved area. And, thirdly, the morphogeny of the species of *Syringothyris* and *Tylothyris* (North, 1920,

pp. 176, 188, 199) apparently indicates a phyletic seriation in which the ancestral forms are typically spiriferoid in shape, while the later forms have the prominent and frequently recurved area. Consequently it would seem that the occurrence of holoperipheral growth in these forms with a high area is a secondary reversion that is cyclically homœomorphous with the hypothetical pre-rhynchonelloid ancestor.

Assuming this conclusion to be true, certain further deductions can be made.

Syringothyris differs from *Tylothyris*, *Syringospira*, *Pseudosyrinx*, and the group including *Spirifer distans* in various ways, but in particular in possessing the peculiar internal structure known as a syrinx. If North's conclusions as regards the evolution of the group be accepted, it is evident that the development of the syrinx in *Syringothyris* shows little change, while the phyletic stages show a regression from mixoperipheral to holoperipheral growth: that is, the evolution of the syrinx occurred before the evolution of the high area. In *Tylothyris* and *Spirifer distans*, however, the internal structure is much more simple than in *Syringothyris*, and the development of a high area is unaccompanied by the presence of a syrinx—it occurred before the evolution of a syrinx, if that structure be potentially possible. In other words, the development of a high area in *Syringothyris* is wholly unconnected with the comparable development in *Tylothyris* and *Spirifer distans*.

In similar fashion, *Pseudosyrinx* (Weller, 1914, p. 404) is as advanced as *Syringothyris* and *Tylothyris* in the height of its cardinal area, but is much less complicated in its septal development, possessing only simple apical plates. *Syringospira*, on the other hand, is more complicated than any of the three above-mentioned genera in septal development (in the spondylium-like fusion of the apical plates), in the extreme height of its area, and in the development of costæ upon the dorsal mesial fold*. It is clear, therefore, that these genera are not

* Compare in this respect "*Spirifer (Syringothyris) sibericus*" Lebedew (1920, pl. x. figs. 11-13) and "*Spirifer julii*" Dehée (1920, p. 19). *Spirifer distans* also agrees in possessing a costate fold, and, like *Syringospira*, is unpunctate.

genetically connected, and their superficial similarity is the result of the parallel evolution of a high flat cardinal area.

Probably also *Cyrtia*, *Cyrtina*, and *Davidsonina* are all genera that have developed a high area independently—possibly several times within each genus as at present understood. Thus it is manifest that the striate *Cyrtia exporrecta* (Wahlenberg) of the Wenlock cannot be genetically related, except collaterally, to the lævigata *Cyrtia simplex* (Phillips) of the Devonian. Again, the relatively flat cardinal area of *Davidsonina septosa* (Phillips) is relatively narrow compared with the strongly curved area of *Cyrtina carbonaria* M'Coy, while both species differ markedly from *Cyrtina heteroclita* (Defrance) in the detailed characters of their ornament and in the structure of the ventral spondylium (see Frederiks, 1916, p. 8; 1926, p. 411; Kozłowski, 1929, p. 201).

The systematic criterion of a high cardinal area is thus seen to be only one of morphological equivalence, having no phylogenetic value whatever. This conclusion is partially expressed by a reference of the outwardly similar forms to different genera. It applies equally pertinently to larger divisions, such as the Syringothyridæ of Schuchert and LeVene, or the third section of the Spiriferinæ of Paeckelmann, which are, as at present defined, merely grade-groups in the structural evolution of a single biocharacter.

In the majority of spirifers, however, there is not this development of a high cardinal area, but the ventral umbo remains of more or less the same size and degree of incurvature throughout. On the other hand, there is much variation in the width of the area, which has been used by a number of people for systematic purposes. Buckman (1908, p. 29), in particular, approved of the criterion, and besides resuscitating M'Coy's genus *Fusella* for costate forms with an alate hinge-line, he suggested a division of *Reticularia* to be based on the length of the hinge-line.

The first suggestion that the cardinal development is scarcely of systematic value is derived directly from a study of the ontogeny of nearly all megathyrid and megistothyrid adults, which shows that the nepionic and neanic stages are almost invariably brachythyrid.

If then the length of the hinge-line is to be used for purposes of classification, it follows that the young stages of these forms will be separated from the adults, which would lend a certain incongruity to the arrangement. On the other hand, if this ontogenetic change from brachythyrid to megathyrid to megistothyrid have any paligenetic foundation, it immediately indicates a genetic connection between the two superficially different types. Secondly, the current theories concerning the origin of a long hinge-line are of interest: the one, of Beecher (1891, p. 350) and Swinnerton (1923, p. 89), amongst others, supposing it to have resulted from a "shortening of the pedicle [bringing] the posterior part of the shell in more and more close proximity to [the] object of support, and as growth cannot take place in that direction, it increases laterally, resulting in broader forms with extended hinge-areas"; the other of Orton (1914, p. 298), considering it to have ensued from the increased efficiency of the food-transporting doubly-spiral lophophore. In either case, habitat and mode of life are essential factors, so that its development is to be expected *à priori* in different and unconnected groups. Lastly, the fossils themselves show that such phylogenetic development has occurred. Thus there is an increase in the relative length of the hinge-line (though the cardinal angles never become acute) in the British species of *Reticularia* (George, 1932, p. 534), which is manifestly independent of the comparable increase occurring in the lævigata martinioids, of which *Spirifer buckmani* George (1932, p. 557) may be cited as an example, or of the costate group including *Spirifer pinguis* Sowerby and *Spirifer rotundatus* Sowerby. In a totally different striate and costate group, the genus *Eospirifer* of the Silurian, the morphogenetic change from the true *Spirifer radiatus* Sowerby to such a form as that figured by Davidson (vol. iii. 1866, pl. ix. fig. 2) under the same name is again obviously a wholly independent development; a similar observation probably applies to the species of *Crispella* and *Delthyris* (Kozłowski, 1929, p. 189); it certainly applies to the members of the Ambocoeliinæ (George, 1931, p. 42). The ontogeny of the megistothyrid Devonian species *Spirifer posterus* Hall & Clarke (1894, pl. xxxiv. figs. 27-31) illustrates yet another separate seriation to an alate stage, differing

markedly from the Carboniferous *Spirifer fusiformis* Phillips or the Permian *Spirifer alatus* (Schlotheim). Even amongst closely related forms, the trend may be constantly repeated, as demonstrated by Fenton (1931, p. 47). Examples could be multiplied, but sufficient have been indicated for the purpose of the present argument.

The length of the hinge-line in the adult is thus seen to be merely a morphological end-stage in a continuous ontogenetic and phylogenetic seriation, and a classification that has any pretensions to an evolutionary foundation cannot accept such genera as *Brachythyris* and *Tangshanella* (Chao, 1929, p. 57) solely on the original diagnosis of their short hinge-line. *Fusella*, at the other extreme, is equally ill-founded, particularly as re-defined by Buckman, who included within it very diverse species whose one claim to a common grouping was their megistothyrid hinge-line; similarly, *Brachythyris* Frederiks (1926, p. 401) (= *Anelasma* Ivanow, 1925, p. 108) is also probably only a form-genus.

(ii.) Costation.

The development or otherwise of ornament has been and is still being used as one of the main criteria for the major division of the Spiriferidae. In particular, the martinoids, since the days of Phillips, have been regarded as a self-contained group, as also have the reticulate species. But on grounds *à priori*, it would seem, by analogy with other kinds of similarly ornamented shells, such as the ammonites and the gastropods, that the development of ornament should commence with a laevigate stage. That this is so is clearly indicated by such species as *Crispella laeviplicata* Kozłowski (1929, p. 195), *Spirifer linguiferus* Phillips, and *Martinia multicostata* George (1927, p. 114) *, which possess ribs only along the anterior fringes of the shell, and although definite lineages have not yet been established, it is fairly certain that *Brachy-*

* With these forms may be compared species of *Eospirifer* (e.g., Davidson, vol. iii. 1886, pl. ix. fig. 2; Hall & Clarke, 1894, pl. xxi. figs. 1, 5, 7), of *Spirifer* (sensu lato) (e.g., *Spirifer moosakhalensis* Davidson; *Spirifer cameratus* Morton, in Hall & Clarke, 1894, pl. xxxii. fig. 11), and of *Reticularia* (sensu lato) (e.g., Hall & Clarke, 1894, pl. xxxvi. fig. 18), in which costae are secondarily superposed on a basic ornament of striae, or minor costae, or spines, as the case may be, and are thus manifestly independent developments.

thyris-like forms have been evolved from smooth martinoids merely by the development of costation. Indeed, the sole other criterion that has been used to distinguish *Brachythyris* from *Martinia* (the presence of ventral apical plates in the former) is probably inapplicable, as the type of *Brachythyris*, *Spirifer ovalis* Phillips, seems to be aseptate.

It has already been shown that there is a progressive series between short-hinged and long-hinged forms. It is therefore to be expected that there should be a continuous seriation between glabrous brachythyrid forms and completely costate megathyrid forms of appearance similar to "normal" spirifers, such as *Spirifer bisulcatus* Sowerby.

The recognition of a genus *Spirifer*, based on the criteria of cardinal development and costation, is thus untenable genetically.

This conception of the evolution of costate forms from glabrous forms scarcely agrees with the conclusions of Buckman (1908, p. 28) *, though his theories were also truly genetic. Believing the distinction between *Martinia* and *Reticularia* to rest in the presence of apical plates, he considered that many smooth or pseudo-smooth species referred to the former genus were really members of the latter that had catagenetically lost their ornament; amongst these were *Spirifer glaberrimus* de Koninck, *Spirifer latus* Brown (see Muir-Wood, 1926, p. 243), and *Spirifer buckmani* George. By an analogy that is not obvious, he further concluded that many of the smooth forms that manifestly could not be *Reticularia* were the catagenetic developments of costate series. Chiefly on the basis of likeness in shape, he regarded *Spirifer linguiferus* as the smooth development of *Spirifer ovalis*, while *Spirifer decorus* Phillips might be a descendant of *Spirifer planatus* Phillips or *Spirifer reedi* Davidson. But, apart from his initial error in supposing the ornament of *Reticularia* to be degenerate (George, 1932, p. 538), his analogy does not seem to be valid. According to his own theories, the evolution of smooth *Martinia*-like forms has occurred in *Reticularia* by an acceleration

* In a former paper (1927, p. 115) I followed Buckman in his conclusions, though I regarded some smooth or partly costate forms as primitive.

of development, and *Spirifer (Reticularia) obtusus* Sowerby is supposed to show "faint but distinct traces of a reticulate youth developing into a smooth adult." A strict analogy with the costate forms demands that similar tachygenesis of ornament should occur in their seriation also, but, so far as I am aware, no spiriferoid shell is ornamented umbonally with costæ, while being smooth towards the anterior margin. On the contrary, all the forms that are partially ornamented are costate anteriorly, but smooth umbonally; if then they are degenerate, this has occurred as a result of bradygenesis. There is no evidence whatever for such retardation, and a simpler explanation is to regard them as primitively smooth. It is concluded that the martinoids, morphologically conceived, are the actual or potential ancestors of *Brachythyris*-like and *Spirifer*-like forms.

But, assuming this conclusion to be true, it does not follow that evolution of the costate megathyrid species has been a straight-forward development from "*Martinia*" through "*Brachythyris*" to "*Spirifer*." On the contrary, it has been much complicated by the independence of the relative speeds of progression of the various biocharacters and by differences in detailed form. Thus *Spirifer buckmani* is a submegathyrid species possessing a completely smooth shell on which there is no evidence of an ornamented ancestry, and presumably it is primitively glabrous, Buckman's opinion to the contrary notwithstanding. That is, a spiriferoid hinge-line, with sub-acute cardinal angles, is accompanied by a martinoid shell-surface. Again, the true brachythyrids (of the species-group of the genotype of *Brachythyris*), including *Brachythyris ovalis* (Phillips) and *Brachythyris hemispherica* M'Coy, frequently possess a hinge-line shorter than that of many of the true martinoids, such as, for example, *Spirifer decorus* Phillips. In the details of their ornament, the members of the *ovalis* group possess wide flat costæ separated by angular furrows only slightly incised; whereas such a form as "*Brachythyris*" *planicosta* M'Coy is multicostate, each rib being narrow and separated from its neighbours by relatively deep furrows; while in "*Brachythyris*" *integricosta* (Phillips) the ribs are prominent and well rounded, much wider than those of "*Brachythyris*" *planicosta*, but not so wide as those of the *ovalis* group.

The submegathyrid forms of the latter appear to include *Brachythyris rotundata* (Sowerby) and *Brachythyris beani* (Brown), while *Brachythyris pinguis* (Sowerby) is probably not far removed. The corresponding forms of the *integricosta* group probably include specimens that have been in the past referred to "*Spirifer bisulcatus*" and its homœomorphs.

There is a still more obvious distinction of true genetic significance in the development of costate ornament that is reflected in the classifications of numerous people, beginning with von Buch (1837; see also de Koninck, 1842, p. 233; Quenstedt, 1885, p. 725; Hall & Clarke, 1894, pp. 21, 28; Paeckelmann, 1931, p. 59). This is the distinction between the *Ostiolati* and the *Aperturati* based on the type of dorsal mesial fold and ventral sulcus: in the former group these are devoid of ornament, whereas in the latter they are costate. Without being acquainted with the phylogenies of the different forms, it is difficult to say in any particular instance whether the costæ are a later development than those of the flanks or whether they evolved synchronously. It is evident that in the truly ostiolate forms, such as the species of *Hysterolites*, *Quadrifarius*, and most of the syringothyroids, progression in the development of a megathyrid hinge-line and of lateral costæ has far outrun the development of costæ on the fold, which, presumably, is not inherently impossible in those groups. Likewise, most of the true brachythyrids, including *Brachythyris ovalis* itself, possess a non-costate fold, but in some, such as *Brachythyris rotundata* and *Brachythyris pinguis*, there are feeble indications of dichotomy, also occurring in forms that are otherwise very similar to *Brachythyris ovalis* and *Brachythyris hemispherica*. In other brachythyroid forms, however, the short hinge-line and costate lateral slopes are accompanied by strong costæ on the fold; these are well displayed by "*Brachythyris*" *integricosta* and *Spirifer duplicicostus* (Phillips), and by the species of *Munella* and *Tangshanella*, in none of which is there any evidence of lag in the development of the median ribs.

It is clear, therefore, that there are a number of permutations of the various developments of the external characters of shape and ornament, and the *Ostiolati*, judged solely on the evidence of their external form,

are morphogenetically distinguishable from the Aperturati on the sound basis of the relative speeds of development of the three sets of biocharacters: development of a megathyrid hinge, development of lateral costæ, development of mesial costæ. It is not denied, however, that within the Ostiolati there are probably many minor lines of parallel evolution and convergence; but these cannot be resolved on the evidence at present available. There is no doubt that the Aperturati are polyphyletic, the early stages of at least three different stocks being represented by the *ovalis* group, the *integricosta* group, and the *duplicicostus* group; there are certainly many others, including, for example, the "syringothyroid" *Syringospira*.

Considered from this genetic standpoint, the "normal" *Spirifer*-like genera of most modern classifications are manifestly no more than a heterogeneous mixture of end-forms having a superficial resemblance only because they are evolved along similar lines. Many of the forms now included under "*Spirifer bisulcatus*," for example, are members of the *integricosta* group, and differ only in their longer hinge-line; similarly, species of *Spirifer striatus* form are probably descended from the *duplicicostus* group; and it has already been pointed out that the *ovalis* group contains the spiriferoid *Brachythyris rotundata* and *Brachythyris beani*. Further, it is seen that the genus *Brachythyris*, leading from "*Martinia*" on the one hand to "*Spirifer*" on the other, is only a halfway house containing wholly unrelated travellers who happen to be following the same evolutionary route: it is the brachiopod equivalent of the old-time comprehensive and indiscriminate ammonoid genus *Amaltheus*.

I have elsewhere (1927, p. 107) attempted to introduce some order into the small group of brachythyroids of the British Avonian rocks, but with little success. Nevertheless, it is clear that in the development of mesial costæ these forms have adopted two different plans, which may serve as truly differential characters in classification*. The principle depends on the fact that the *ovalis* group, in the splitting of the mesial fold, adopt

* A similar truly differential separation can be made on the same ground in other groups, as, for example, the species of *Delthyris*, the gens of *Spirifer undiferus* Roemer, and the Silurian gens of *Spirifer bijugosus* McCoy.

a process of dichotomy: the initial stages are well seen in *Brachythyris pinguis* and *Brachythyris rotundata*. That is, the fold has a median groove, and there is an even number of ribs. In the *integricosta* group, on the other hand, the fold is primarily imparicostate, and the development of a median groove is a secondary event, if it occurs. But several factors, at least in theory, militate against the invariable application of this scheme. Thus in some forms it is difficult to be certain that the formation of the median incision occurs either definitely before or definitely after the introduction of the two lateral, and in any particular case there may be relative acceleration of the lateral over the median, or *vice versa*. Also there is a tendency for the whole costal development to be tachygenetically accelerated as evolution proceeds, so that the smooth umbonal stage is completely skipped, and the costæ are present, so far as may be observed, in the nepionic stages. Incidentally, even within the paricostate *ovalis* group, there is marked independence of the various biocharacters as regards their rates of progression, and while the fold of the laterally-ribbed *Brachythyris ovalis* is entire, that of the glabrous *Brachythyris sulcata* George is grooved; the gens must be regarded as a plexus of complicated inter-relations, rather than a simply evolving "lineage" or even group of lineages; the forms as at present known display morphogeny and seriation, rather than phylogeny and evolution.

(iii.) Plication.

The distinction between plication and costation is probably not of fundamental structural import, and the theoretical remarks of the preceding section probably apply in large measure to the development of plicæ.

The earliest stage of nearly all Brachiopoda is lenticular (convexi-convex) with a straight anterior margin. From this primitive stage, represented in the spirifers by many of the martinioids, and by the species of *Phricodothyris*, the development proceeds along lines similar to those described by Buckman as occurring in the terebratuloids, and it is unnecessary to dilate upon the various stages exemplified. These have rarely been used for systematic purposes, but it seems that they can be of some help at least in indicating divergent evolution or absence of

relationship. Thus I (1931, p. 41) have shown that *Ambocœlia* and *Crurithyris* are profoundly different from the martinioids and the species referred to *Reticularia* in their development of a planate or sulcate dorsal valve, and on that account, if on no other, they are to be considered an aberrant group. A more interesting case is that provided by the gens of *Spirifer triradialis* Phillips. The various stages occurring in this group are not entirely known, but the main morphogenetic changes appear to be as follows: The most primitive form is very similar to, and almost indistinguishable from, a normal recti-marginate brachythyrid glabrous martinioid. A specialisation of the mesial region occurs by the development of a central plication that becomes bounded laterally by two or more plications, below which it sinks until the anterior margin becomes essentially inverse; the median portion of the dorsal valve is then very strongly triplicate along its whole length. This development is markedly different from that of the "normal" martinioids and brachythyroids, in which the initial recti-marginate stage is followed by a uniplicate or sulciplicate stage. The difference is further enhanced by the complete absence of minor costæ on the flanks of most members of the *triradialis* group, and by the precise limitation of the plicate mesial area. The reference of this group to *Brachythyris*, on the basis of the short hinge-line and costate development (without regard to the precise nature of the costate development), is thus seen to obscure crudely the true relationships of the forms and the divergence that has occurred from the ancestral glabrous stock.

(iv.) *Minor Ornament.*

In some classifications very much emphasis has been laid upon the shell-structure and upon the character of the minute surface-ornament. While this is perhaps an appropriate criterion for the separation of genera, its usage for the distinction of subfamily divisions may not have the same adequate structural foundation.

The "Martiniinæ" have often been regarded as characterised by a punctate epidermis, the punctations not passing through the thickness of the shell to the interior. So little being known about the morphological

and physiological significance of the structure, it is dangerous to be dogmatic. But presumably in these forms, as in modern telotremes, the pores contained fine papillæ extending from the mantle. These cæcal prolongations could have functioned for only a very brief while, and were retracted or became obsolete as the succeeding (and underlying) layer of shell was deposited: they occurred only along the anterior margin of the living animal. A precisely similar description applies to the spines of *Crurithyris* (George, 1931, p. 37), and it may possibly be that these spines are developments out of an antecedent punctate form. In other words, punctæ or spines (of that type) are not necessarily absolute systematic criteria, if classification is to be on a genetic basis.

If the previous conclusions concerning spiriferoid morphogeny have any truth, then the punctate glabrous martinoids are the ancestors of the brachythyrid and megathyrid costate forms. While the former are almost invariably found to be punctate when the outer shell-layer is adequately preserved, it is rare for the punctæ to be present in the more advanced forms. Occasionally they occur in costate brachythyrid species, but, so far as I am aware, they are not recorded as being present in the shell of any long-hinged *Spirifer*-like form. Evolution would thus seem to have proceeded by a loss of punctæ—at any rate, amongst these forms, in which case it is seen that the character of punctation is again not diagnostic.

In such genera as *Spiriferina* and *Punctospirifer*, on the other hand, the punctations are of a different type, penetrating the whole thickness of the shell to the interior. Judging by analogy with modern terebratuloids, it would appear that the cæcal prolongations of the mantle persisted in each pore throughout life; they are thus structurally and probably physiologically different from those of the martinoids. As these punctate forms are not known before the Devonian, or in any abundance before the Carboniferous, it is probable that they are specialised out of normal impunctate spirifers—that is, the punctate condition is not primitive (compare Thomson, 1925, p. 429). If this happened but once, the whole of the punctate forms being the evolutionary offshoots

of this stock, then obviously punctation is a truly differential character. On the other hand, if the various occurrences of punctæ are homœomorphic, then punctation is a biocharacter to be used only with caution and over a limited range. It must be confessed that there is no direct evidence for either conclusion, but the development of analogous punctæ in totally unconnected groups, such as the terebratuloids, the retziids, and the cyrtinids, suggests the possibility of homœomorphy, even if it does not prove it.

I avoid a discussion of the crenulations and spines of various genera, such as *Squamularia* and *Spinocyrtia*, as their detailed structure is not adequately described. Nevertheless, there can be little doubt that in some instances, as those of the reticulate forms (George, 1932, p. 527), the development of a similar appearance is homœomorphic, and the association by Paeckelmann (1931, p. 43) of such diverse genera as *Prosserella*, *Elytha*, *Emanuella*, *Eoreticularia*, *Spirelytha*, and *Squamularia* as sections of the "subgenus" *Reticularia* exemplifies morphological classification of the crudest kind, comparable with the *Reticulariinae* of Waagen in which *Ambocœlia* and its analogues, also spinous forms, were included (see George, 1931, p. 41).

The double-barrelled spines of *Phricodothyris* (George, 1932, p. 528) deserve some mention, however. These are so specialised that it is unlikely that they should have been evolved homœomorphically in two separate stocks, and they occur in such a self-contained group, obviously closely similar in other respects, that they almost certainly constitute a truly differential character for the recognition of the genus. If this conclusion be allowed, it has far-reaching effects on the principles of classification, as will be developed in the following section.

(v.) *Internal Plates.*

Following the classification of Waagen, who was himself anticipated in details by (for example) Davidson and M'Coy, it has been customary to regard the development of various internal structures as of more fundamental importance for systematic purposes than the superficial characters of external shape and ornament. As Waagen put it, the ornament is merely of practical use in classification, while the criterion of internal plates is truly

scientific. This position has been carried to its logical extreme by Frederiks, and in doing so he has made obvious its complete artificiality, incidentally demonstrating that external characters are not intrinsically of less value than internal. An examination of the fossils themselves, without the application *à priori* of any particular hypothesis, leads to the same conclusion.

In many of the martinoids, except in *Martiniopsis* and similar forms, the development of apical plates in the ventral valve is insignificant or nil. In the true brachythyrids, on the other hand, some of the species are aseptate; but others, of almost identical appearance, especially in the character of the low flat costæ, are incipiently septate*; still others, such as the partially costate *Spirifer linguiferus* Phillips, are strongly septate. Many megathyrid forms of the appearance of *Spirifer bisulcatus* are also only incipiently septate, while others are completely aseptate; the majority, however, possess strong apical plates, though these rarely attain the stages of the Lower Avonian forms, of the species of *Choristites* and *Spiriferella*, and of the Upper Carboniferous species of which *Spirifer pennystonensis* (George, 1928) is an example. In the brachythyrid *Spirifer duplicicostus* the apical plates are strongly developed, as they also are in the submegathyrid glabrous *Spirifer buckmani* and the glabrous brachythyrid *Spirifer oblatulus* Sowerby. The last-named is homœomorphic with *Spirifer decorus* Phillips, also glabrous and brachythyrid, but aseptate, and with *Reticularia obtusa* (Sowerby), pseudo-glabrous when exfoliated, brachythyrid, but with strongly developed apical plates and a couseptoid; with these also may be compared the finely striate *Eospirifer globosus* (Salter) (in Davidson, vol. iii. 1866, pl. ix. fig. 7) of the Silurian. Most of the Ostiolati are strongly septate, while many of the Aperturati are feebly septate or aseptate; yet the latter group is the more advanced in the degree of costation. It would appear therefore that the development of apical plates has occurred independently in many stocks of spirifers—a conclusion that is scarcely to be avoided if analogy with the septate and aseptate terebratuloids and rhynchonelloids be taken into account (see Leidhold, 1922, p. 457). Further, in costate forms

* Thus Ivanow (1925, p. 108) distinguishes *Anolasma* (= *Brachythyridina*) from *Spirifer* and *Choristites* on its insignificant apical plates.

of the same degree of costation, such as *Spirifer tornacensis* de Koninck and *Spirifer duplicicostus*, there is some ontogenetic evidence for different phylogenies; thus the former species possesses apical plates that form continuous lamellæ across the valve, whereas in the latter species the plates are discontinuous, part growing from the sides of the delthyrium, part from the floor of the valve, the two meeting at an obtuse angle. Nevertheless, the lack of detailed knowledge of phylogeny makes it difficult to provide a definite case of the evolution of two separate stocks showing such parallelism, and the conclusion is largely presumptive. It is also based on the assumption that the absence of plates in many of the martinoids is primitive, and not the result of catagenesis; such an assumption is in accordance with their primitive nature in other respects also, as in the absence of ornament and the brachythyrid nature of the hinge.

The reticulum of evolution thus becomes ever more complicated. It has already been shown that the relative speeds of progression of the characters of costation and the length of the hinge-line have resulted in various combinations of different stages of those features. It is now seen that the introduction of a third and totally independent factor—internal septation—increases the permutational possibilities enormously, and the unravelling of the numerous seriations becomes an exceedingly difficult task.

Similar remarks apply to other internal structures. Thus it is manifest that the median septum of the ventral valve of *Reticularia* is not evidence of generic relationship with *Spiriferina*, for example, while the structure in the latter genus (a pseudo-septum) differs profoundly, according to Frederiks, in its detailed morphology from the euseptum of *Spiriferellina*. The septum in the *Crispella-Delthyris* series also appears to be another independent development (Kozłowski, 1929, p. 189).

The ventral spondylium presents yet another example. The clearest case is perhaps that provided by *Phricodothyris* and *Spirelytha*. The former genus includes the group of *Spirifer lineatus* (Martin), and was formerly included with *Spirifer imbricatus* and similar forms within the genus *Reticularia*. But the species of the genus are in reality only homœomorphic with the true *Reti-*

cularia, and constitute an extremely specialised group characterized by the peculiar ornament of hooked double-barrelled spines (for details, see George, 1932). In Britain, the species occur in abundance in the uppermost beds of the Avonian (D_2 and D_3 Zones), and their intimate association and unity of form make the conclusion inevitable that they are members of one species-group: indeed, the distinction between the species is based only on minute details of shape and ornament. But within a collection of specimens derived from a single locality and apparently referable to a single species, some are aseptate, others are only incipiently septate, while still others possess apical plates traversing the ventral umbo—that is, the forms provide a clear example of the independent development of apical plates, and demonstrate the danger of using these internal structures as differential characters for determining phylogeny or for the criteria of a genetic classification.

The same line of argument may be carried still further, and, if the double-barrelled spines be sufficient evidence of a broad genetic relationship, the *Phricodothyris* group be traced into Upper Carboniferous rocks. Some of these higher forms are persistently aseptate, indicating that progression is again not straight-forward, but that there is much independence of the biocharacters. Other forms, however, are much more advanced, and have been placed in the genus *Spirelytha* by Frederiks. Apical plates are usually strongly developed; these tend to unite and ankylose, while there may also be present a euseptoid, the whole forming a structure that Frederiks calls a pseudo-spondylium.

The comparable approximation of the plates in *Munella* and their fusion in species of *Spiriferella* and *Choristites* (if Frederiks' interpretation of the structures be accepted—see Frederiks, 1927, pl. i. figs. 4, 7, 9) are manifestly developments that proceeded independently of the parallel process in the spinous forms, while the more normal incipient spondylium of species of *Prosserella* (Grabau, 1910, p. 38), for example, was evolved at a much earlier period. Again, it would appear that the well-developed spondylia of *Cyrtina* and *Davidsonina* are unrelated structures, either to each other (*fide* Frederiks, and Kozłowski, 1929, p. 201) or to those of the former genera.

As to other groups, it is further clear that the spondylia of the specialised pentamerids are a product of evolution within that group, and do not indicate genetic affinity with the spiriferoids, while *Camarophoria* may be an aberrant rhynchonelloid; certainly the camerate structures of *Camarotoechia* are independently developed.

It is thus manifest that in the spirifers apical plates have been evolved many times in a number of separate groups, while the more specialised and complex spondylia have also evolved more than once in unconnected genera. Analogy with other brachiopod families supports the conclusion that such internal structures, the grades of which Frederiks and others have distinguished systematically, show a progressive seriation in their development, and are not differential criteria for the purposes of classification. This is not to deny that the minute details of formation of the structures may show considerable differences in the various groups, and may be of use in the determination of the several lineages.

In a similar way, the development of crural plates in the dorsal valve has been considered diagnostic of certain genera—*Ambocelia*, for example. But it has been shown that in the similar genus *Crurithyris* (George, 1931, p. 39) some species are only incipiently septate, while in others the plates may be obsolescent. These stages may indicate that the genus as at present conceived embraces several more or less independent stocks—or, on the other hand, there may be a cyclical development of the plates along one line of seriation. In either case, nearly all the other biocharacters demonstrate the relationship of the species, and the septal changes occur within the confines of the genus—that is, the crural plates are not diagnostic.

The more complex internal structures of other spirifers, such as the syringothyroids, may be unique to the groups concerned, in which case they are truly differential. But so little is known of the evolution of these structures, or of the species in which they occur, that no definite conclusion can be arrived at. It is probable, however, as Frederiks has shown, that the syrinx of some forms is developed out of the delthyrial plate, the presence of the latter constituting his "ostiolate" stage. But the delthyrial plate occurs in a number of unrelated

forms, such as, for example, *Spirifer duplicicostus* and *Spirifer distans*, and is itself not indicative of genetic affinity. The implication is that the more complex structures developed out of it may be homœomorphic also. In any case, the unsupported spondylium of *Pseudosyrinx* is not remotely comparable with a true syrinx, and the association of that genus with *Syringothyris* on the basis of its complicated internal structure is but another example of crude morphological classification.

VI. CONCLUSION.

The preceding remarks are far from being exhaustive, but they illustrate sufficiently the main theme running through this paper. All, or nearly all, the more obvious biocharacters of the Spiriferidæ that have been used in classification are progressive. A classification that is founded upon the grades of development of a particular biocharacter will not agree with another classification of the same kind in which a different character is taken as the principal criterion. For the biocharacters do not possess constant speeds of development throughout the family, and they have evolved independently in different genera; and there is a bewildering series of combinations of stages that permits of innumerable groupings. A morphological classification thus depends largely on the arbitrary emphasis laid upon some particular biocharacter, which will not be the same (and has not been the same!) for all observers. Further, no convenient single biocharacter persists throughout the family, and most previous workers have been obliged to introduce new criteria as occasion arose. The only effective and consistent morphological scheme with which I am acquainted is that of Frederiks, and his success is largely due to the imposition of an entirely arbitrary framework into which almost any brachiopods could fit; it is not the result of a study of the specimens as such, and may be compared with the old-time classification of ammonites on the two criteria of degree of incoiling and costate development. Frederiks's scheme is not compatible with that of Schuchert and LeVene, for example, and neither is compatible with a genetic classification. It follows that many of Frederiks's genera are meaningless in terms of the latter, or are admissible only accidentally,

after emendation, because of the previous lack of a convenient name.

No intrinsic value attaches to a genetic classification as such. But the whole aim of classification is co-ordination, and from a systematic standpoint it is generally conceded that the most profound and comprehensive co-ordination is attained on an evolutionary basis. And the whole charge against a morphological classification, such as that of Frederiks, is its complete absence of any reference, even implicit, to phylogeny; it separates father from son, and unites under a common roof a heterogeneous mixture of totally unrelated forms. In the words of Lang (1923, p. 132), speaking similarly of corals, "... the genera as at present interpreted cut across the lineages ... the boundaries of the genera will have to be adjusted to include members of one lineage or of a few related lineages"; precisely the same remark applies to larger divisions than genera. To combine a morphological with a genetic classification, as Hall & Clarke, Schuchert & LeVene, and PaECKELMANN have done indicates a confusion of thought and an inconsistency of method, manifest in the result by a lack of clarity and a strain of application: often there is a obvious clash between the two points of view within the one scheme, as remarked earlier in this paper.

In the absence of differentials (except minor differentials), the method of a genetic classification is that outlined by Lang (1923, p. 128) and Swinnerton (1923, p. 395; 1921, p. 357), in which the morphogeny of a number of trends or progressive biocharacters is recognized, and each lineage or plexus separated from its neighbours on the basis of the relative degrees of advancement of the various biocharacters. The method is probably not absolute, for there seem to be too many parallel series and too few biocharacters, and the effects of homœomorphy cannot be entirely eliminated. The method also is only applicable within more or less limited groups, and I see at present no possibility of a grand scheme to embrace the whole of the Spiriferidæ. Nevertheless, the small beginnings that have already been made, as with the martinioid and reticulate forms, are not without promise, and may lead to more comprehensive conclusions in due course.

LIST OF WORKS TO WHICH REFERENCE IS MADE.

- BEECHER, C. E. 1891. "The Development of the Brachiopoda." Amer. Journ. Sci. vol. xh. p. 343.
- BUCH, L. VON. 1837. 'Ueber *Delthyria*, oder *Spirifer* und *Orthis*.' BUCKMAN, S. S. 1908. "Brachiopod Homœomorphs: '*Spirifer glaber*.'" Q. J. G. S. vol. lxiv. p. 27.
- . 1917. "The Brachiopoda of the Namau Beds, Northern Shan States, Burma." Mem. Geol. Surv. India, Pal. Indica, n.s. vol. iii. no. 2.
- CHAO, Y. T. 1929. "Carboniferous and Permian Spiriferids of China." Palæont. Sinica, ser. B, vol. xi, fasc. 1.
- DAVIDSON, T. 1851-84. "British Fossil Brachiopoda." Mon. Pal. Soc.
- DEHSE, R. 1929. "Description de la Faune d'Etrœungt." Mém. Soc. Géol. France, n.s. vol. v. no. 11, p. 5.
- ETHERIDGE, R. 1888. "Fossils of the British Isles," vol. 1.
- FENTON, C. L. 1931. "Studies of Evolution in the Genus *Spirifer*." Publ. Wagner Inst. Sci. vol. ii.
- FREDERIKS, G. 1916. "On some Upper Paleozoic Brachiopoda of Eurasia." Mém. Com. Géol. Russie, n.s. no. 156.
- . 1926. "Table pour Définition des Genres de la Famille Spiriferidae." Bull. Acad. Sci. U.R.S.S. ser. vi. vol. xx. no. 5-6, p. 303.
- . 1927. "Der Apikalapparat der Brachiopoda Testicardines (Morphologische Nomenklatur)." N. J. f. Min. vol. lvii. B, p. 1.
- GEORGE, T. N. 1927. "Studies in Avonian Brachiopoda.—I. The Genera *Brachythyris* and *Martina*." Geol. Mag. vol. lxiv. p. 106.
- . 1928. "*Spirifer pennystonensis*, sp. n., from the Coal Measures of Coalbrookdale." Ann. & Mag. Nat. Hist. ser. 10, vol. 1. p. 108.
- . 1931. "*Ambocelia* Hall and certain similar British Spiriferidae." Q. J. G. S. vol. lxxxvii. p. 30.
- . 1932. "The British Carboniferous Reticulate Spiriferidae." Q. J. G. S. vol. lxxxviii. p. 516.
- GIRTY, G. H. 1908. "The Guadalupian Fauna." U.S.G.S. Prof. Paper no. 58.
- GRABAU, A. W., in A. W. GRABAU & W. H. SHERZER. 1910. The Monroe Formation of Southern Michigan and adjoining Regions." Geol. Surv. Michigan, ser. 1. no. 2.
- HALL, J., & J. M. CLARKE. 1894. "An Introduction to the Study of the Genera of Paleozoic Brachiopoda." Geol. Surv. New York, Palæont. vol. viii. pt. 2.
- IVANOW, A. 1925. "Sur la systématique et la biologie du genre *Spirifer* et de quelques brachiopodes du C_{II} et C_{III} du gouvernement de Moscou." Bull. Soc. Nat. Moscou, n.s. vol. xxxiii. p. 105.
- KINDLE, E. M. 1909. "The Devonian Fauna of the Ouray Limestone." U.S.G.S. Bull. no. 391.
- KONINCK, L. G. DE. 1842-44. 'Description des Animaux Fossiles qui se trouvent dans le Terrain Carbonifère de Belgique.'
- KOSŁOWSKI, R. "Les Brachiopodes Gothlandiens de la Podolie Polonaise." Palæont. Polonica, vol. i. p. 1.
- LANG, W. D. "Trends in British Carboniferous Corals." Proc. Geol. Assoc. vol. xxxii. p. 120.
- LEBEDIEW, N. 1929. "Spiriferidae aus dem Karbon des Donetzbeckens und einige anderer Gebiete von Russland." Zeitschr. Deutsch. Geol. Ges. vol. lxxxi. p. 241.
- LEIDOLD, C. 1922. "*Rhynchonella Doederleini* Davids. eine kritische Brachiopoden-Untersuchung." N. J. f. Min. vol. xlv. B, p. 423.

- LEIDHOLD, C. 1928. "Beitrag zur Kenntnis der Fauna des rheinisch Strungcephalenkalkes, insbesondere seiner Brachiopodenfauna." Abhandl. Preuss. Geol. Land. vol. cix. p. 1.
- M'Coy, F. 1844. 'Synopsis of the Characters of the Carboniferous Limestone Fossils of Ireland.'
- Muir-Wood, H. M. 1926. "Description of a new Species of *Spirifer* and one of *Reticularia* from the Lower Carboniferous near Clitheroe." Q. J. G. S. vol. lxxxii. p. 241.
- . 1930. "The Classification of the British Carboniferous Brachiopod Subfamily Productinæ." Ann. & Mag. Nat. Hist. ser. 10, vol. v. p. 100.
- ORTON, J. H. 1914. "On Ciliary Mechanisms in Brachiopods and some Polychætes . . ." Journ. Marine Biol. Assoc. u.s. vol. x. p. 283.
- PAECKELMANN, W. 1931. "Versuch einer zusammenfassenden Systematik der Spiriferideæ King." N. J. f. Min. vol. lxvii. B, p. 1.
- PHILLIPS, J. 1836. 'Illustrations of the Geology of Yorkshire,' vol. ii.
- SCHUCHERT, C. 1897. 'A Synopsis of the American Fossil Brachiopoda.' U.S.G.S. Bull. no. 87.
- , in K. A. von ZITTEL & C. R. EASTMAN. 1913. 'Text-book of Palæontology,' vol. i.
- , & C. M. LEVENE. 1929. 'Fossilium Catalogus.—I. Animalia,' Pars 42. Brachiopoda.
- SOUFIN, H. 1900. "Die Spiriferen Deutschlands." Palæont. Abh. n.s. vol. iv. p. 207.
- QUENSTEDT, F. A. 1885. 'Handbuch der Petrifactenkunde.'
- STEINMANN, G., & DÖDERLEIN, L. 1890. 'Elemente der Palæontologie.'
- SWINNERTON, H. H. 1921. "The Use of Graphs in Palæontology." Geol. Mag. vol. lviii. p. 357.
- . 1923. 'Outlines of Palæontology.'
- THOMAS, T. 1910. "The British Carboniferous Orthotetinae." Mem. Geol. Surv. G. B., Palæont. vol. i. p. 83.
- . 1914. "The British Carboniferous Producti.—Part I." Mem. Geol. Surv. G. B., Palæont. vol. i. p. 197.
- THOMSON, J. A. 1925. "The Interrelations of the Subfamilies of the Telotremata (Brachiopoda)." Ann. & Mag. Nat. Hist. ser. 9, vol. xvi. p. 425.
- TRYON, G. W. 1882. 'Structural and Systematic Conchology.'
- WAAGEN, W. 1879-87. "*Productus*-Limestone Fossils." Palæont. Indica, ser. 13, 'Salt Range Fossils,' vol. i.
- WELLER, S. 1914. "The Mississippian Brachiopoda of the Mississippi Valley." Illinois State Geol. Surv.
- ZITTEL, K. A. von. 1880. 'Grandzuge der Palæontologie,' vol. iii.

L.—*Descriptions and Records of Bees.*—CXLIII.
By T. D. A. COCKERELL, University of Colorado.

Eucara macrognatha (Gerstaecker).

Friese treated *Eucara* (type now designated, *E. laticeps* Friese, 1905) as a subgenus of *Anthophora*. I must certainly agree with Alfken (1932) in associating it with *Tetralonia*, but it is perhaps best regarded as a distinct genus. *Tetralonia sheffieldi* Meade-Waldo (type examined) is a synonym of *E. macrognatha*.

Nomia matha (Cameron).

The *Andrena matha* Cameron, 1905, has been referred to *Colletes*, but an examination of the type in the British Museum shows that it is a *Nomia*.

Crinoglossa neglecta (Smith).

Andrena neglecta Smith, 1879, from Natal, was renamed *A. negligenda* Dalla Torre, on account of the prior *Biareolina neglecta* Dours considered to be an *Andrena*. If *Biareolina* is regarded as a genus, there is no pre-occupation. Meade-Waldo transferred Smith's species to *Colletes*, but a study of the type-female shows it to have the following characters (the abdomen has been stuck on, but doubtless belongs to the specimen):—

Clypeus short, rugoso-punctate; a groove across top of head, behind ocelli; mesothorax with five parallel longitudinal grooves; area of metathorax in the form of a narrow (short) granular channel; stigma rather large, very dark reddish; marginal cell narrower apically than in *Nomia*; second cubital cell square, receiving recurrent nervure before end; basal nervure not very strongly bent, falling just short of nervulus; abdomen broad, very finely punctured, first tergite very short; hind margins of tergites 2 to 4 depressed and pallid, with thin white hair; sternites fringed with long hairs; fifth tergite with a red fringe; apical plate broadly rounded at end.

When I first glanced at this, I thought it was a very aberrant *Halictus*, but on closer examination I was inclined to place it with *Nomia*. It is, however, evidently the hitherto unrecognized female of Friese's genus *Crinoglossa*. It is at least closely allied to *C. natalensis* Friese, but I think it is a distinct species.

Colletes antecessus Cockerell.

Cape Province: Stellenbosch, Nov. 17, 1925 (*R. J. Nel*).
British Museum.

Mesotrichia lautipennis, sp. n.

♀.—Like *M. mixta genuina* Vachal, with the same red hair on thorax anteriorly and at end of abdomen, but differing thus: considerably smaller, length about

20 mm., about 8.5 mm. between wings, but wings long and rather narrow, length 23 mm., of the same rich purple colour, but anterior wings with outer margin broadly pallescent, and the lower apical corner very broadly whitish and translucent; labrum with conspicuous red hair; clypeus less rugose, shining in middle; hair of vertex all black (that of face with a dusky yellowish appearance); first four antennal joints chestnut-red; tegument of upper half of cheeks dusky red; anterior and middle tibiae dusky reddish; spurs of middle tibiae dark red; third and fourth tergites much more finely punctured.

Belgian Congo: Tenke, 1931 (*W. P. Cockerell*).

Anthophora caelestina Cockerell.

Transvaal: Barberton (*Harrison, P. Rendall*). S. Rhodesia: Matopo Hills, April (*J. O.*); Salisbury, Nov. 1903, Oct. 1899 (*G. A. K. Marshall*).

The Matopo Hills ones are rather greener than the others. A Barberton female has ferruginous femora and broader clypeal mark like that of male; a Barberton male has dark femora.

Anthophora plumipes (Fabricius).

Cape Province: Huguenot, Feb. 5-10 (*A. M.*).

This species has an extraordinary range, from the Cape region to the Belgian Congo, and east to Zanzibar (*Hildebrandt*).

Anthophora megasoma, sp. n.

♀.—Length about 22 mm., width 9, anterior wings 16 mm.

Black, very robust, no light markings on head; facial quadrangle longer than broad; antennae entirely black, third joint quite as long as next four together; clypeus convex but with a flattened apex, rugoso-punctate, with a shining keel from upper end to beginning of flattened position; cheeks, occiput, and most of clypeus and sides of face with white hair; but sides of face with black hair intermixed, long black hair between antennae and on vertex; white hair on each side of the bright orange middle ocellus; thorax above entirely covered with dense felt-like orange-fulvous hair, which

also extends to tubercles, and a transverse band below wings; metathorax, and first tergite except apical margin, with similar but rather paler hair; under part and most of sides of thorax with black hair; tegulæ large, dull ferruginous. Wings black, with greenish tints in the cells, and purplish beyond; second cubital cell receives first recurrent nervure slightly before beginning of last third. Legs with black hair, hind basitarsi broad. Abdomen shining black, rather weakly punctured, with no light hair beyond first tergite, except that some of the hairs on each side of apex are pale reddish; fifth tergite with a very heavy black fringe; apical part of venter in middle with pale fulvous-tinted hair. The hair in the region of the ocelli varies from black to white and pale fulvous.

S. Rhodesia: Vumba, Umtali*, May 23-26 (*J. & L. Ogilvie*).

A magnificent species, looking like some *Mesotrichia*, such as *M. apicalis* (Smith) or *M. senior* (Vachal).

It is related to *A. optima* Ckll. much as *A. armata* Friese is to *A. clitelligera* (Friese). It is larger than the species which Friese named *A. gigantea* and *A. gigas*.

Anthophora sefrensis, sp. n.

♂.—Length about 16 mm., anterior wing 12 mm.

Robust, black, including legs and tegulæ; eyes large, pale green; whole face below antennæ, labrum, and large spot on base of mandibles creamy white; face narrow, not much wider than an eye; malar space obsolete; maxillary palpi red, not very long; scape creamy white in front, the antennæ otherwise dark, the flagellum obscurely reddened beneath; third antennal joint long, fourth very short, fifth at least twice as long as fourth, and much longer than sixth; hair of face scanty, white, of front tinged with fulvous, of vertex light ferruginous, of cheeks reddish, but under side of head with long pure white hair; thorax and first tergite densely covered with very bright ferruginous hair,

* "Now we are staying on a farm at the top of the Vumba, which is a mountain outside Umtali, about 5,500 feet high. A drive of an hour and a half up a steep and rough road, but what a glorious place when you get there! We are sitting on top of the world, with ranges and ranges of mountains all around us, and Portuguese East Africa lying practically at our feet.—ALICE MACKIE, May 24."

with no dark hairs intermixed; sides of thorax with paler red hair, and under side with white; second and third tergites minutely punctured, practically bare, with very scanty black hair and a few red ones, especially on depressed part of third; tergites 4 to 6, and sides of apex, with dense fulvous hair, except that it is thin and short at base of fourth, especially at sides; venter with white hair. Wings hyaline, faintly brownish, nervures black; first recurrent nervure joining second cubital cell about middle. Anterior and middle femora, tibiae and basitarsi with long white hair behind; outer side of all the tibiae with short appressed pale fulvous hair; hind tibiae and basitarsi with short dark purplish-brown hair on inner side; middle tarsi not modified; middle trochanters with a thorn-like spine; hind trochanters with two slender spines; hind basitarsi broad, with a strong angular projection beyond the middle anteriorly.

South Oran (N. Africa): Ain Sefra, May 18, 1913 (W. R. & E. H.).

This looks exactly like *Habropoda tarsata* Spinola, but it is a genuine *Anthophora*. The hind basitarsi are of the general type of *A. parietina* (Fab.), but that belongs in another group, having a large malar space.

Type in British Museum.

Anthophora mervensis Radoszkowski.

There is a cotype ♀ in the British Museum. It has exactly the aspect of *A. garrula* and *A. quadrifasciata*, all three with the same kind of face-marks; but *A. mervensis* is distinctly smaller, with much narrower face and smaller, shorter, labrum. The bands on tergites 1 to 3 are tinged with ochreous.

Merv, Transcaspia.

Tetralonia junodi Friese.

Orange Free State: Ficksburg, both sexes (J. O.). Transvaal: Johannesburg, Feb. 1906 (G. Kobrow).

In the British Museum I found a male labelled "Mombasa (*A. J. Chalmley*)."

This is evidently a mistake, and further search showed a female labelled as collected by Chalmley near Johannesburg.

Oxæa flavescens Klug.

Argentina : Misiones, Est. Exp. Loreto (A. A. Ogloblin).

Recorded from Brazil. At the same place, Dr. Ogloblin took *Melitoma euglossoides* Lep. & Serv. at flowers of *Ipomœa*. He also took *Xylocopa nigrocincta* Smith and *X. augusti* Lapeletier.

Pasiphaë coloratipes, sp. n.

♂.—Length 8.4 mm., anterior wing 6.2 mm.

Rather slender, black, with the knees, tibiae, and tarsi clear ferruginous; face and front densely covered with long pale ochreous-tinted hair, white hair on under side of head; hair of thorax scanty, but in region surrounding scutellum long and pale ochreous, in sternal region pure white; mandibles and antennæ black, the flagellum long and stout; a shining crescent bounding the ocelli laterally; mesothorax highly polished, with scattered strong punctures; scutellum similarly sculptured, convex; area of metathorax triangular, highly polished; tegulæ black. Wings greyish hyaline, a little darker at apex; stigma dusky red; nervures black; basal nervure falling a little short of nervulus; second cubital cell very long, receiving first recurrent nervure at a distinctly greater distance from base than second from apex. Anterior femora with abundant long greyish-white hair behind. Abdomen shining, but well punctured; no evident bands, but hind margins of tergites very narrowly obscurely rufescent; apical plate large, broadly rounded, dark red.

Argentina : Est. Exp. Loreto, Misiones (A. A. Ogloblin).

Dr. Ogloblin states that this species is the host of a new Strepsipterous parasite. This bee is allied to the smaller *P. alismatis* (Ducke), from Ceara, N.E. Brazil, and the larger *P. franki* (Friesse) from Buenos Aires.

Pasiphaë lucidula, sp. n.

♂.—Length 8 to 8.5 mm., anterior wing 7.

Black, with the appearance of *P. coloratipes*, but legs black, with anterior tibiae red in front, middle tibiae variably obscure reddish in front, tarsi rather dusky red. The long hair of face and front is very pale, but perceptibly tinted with ochreous; the wings are rather

strongly dusky at apex. This might be taken for a mere variety of *P. coloratipes*, but it is certainly distinct, having the second recurrent nervure joining the second cubital cell very near the end, and the mesothorax (except posteriorly) much more closely punctured. *P. friesei* Joergensen, which I have not seen, must be very similar, but the face has long white (not tawny) hair; it also lives in quite a different region. The smaller *P. iheringi* Schrottky, from Brazil, has some points of resemblance.

Both the species now described have the male legs simple, not modified as in *P. wagneri* Vachal.

Argentina: Est. Exp. Loreto, Misiones (A. A. Ogloblin); five males.

Superficially, this looks just like the male of *P. rufiventris* Spinola, which is black.

Melipona fasciata solani (Cockerell).

Guatemala.

According to the classification given by Mr. H. F. Schwarz in his recent admirable revision of *Melipona*, this falls under *M. fasciata* Latr. as a subspecies.

Trigona alinderi mimica (Alfken).

Belgian Congo: taken in great abundance at Tshibinda (L. O., A. M., W. P. C., J. O., Ckl.), Aug. 21-27.

Most of the specimens have the abdomen well banded, as in the Ruwenzori race, but occasionally the abdominal markings are much reduced, sometimes leaving only a small yellow spot at each side of first tergite and a large one on each side of second. These are all individual variations, but on the average characters the race is readily distinguishable. The type-specimen of var. *nigrita* Alfken in the British Museum has the anterior middle of scutellum black and the abdomen all black. It appears to be a varietal form of *T. topiorum* Ckl. Typical *T. beccarii* Gribodo, of which I possess a cotype, has the scutellum yellow as in *T. alinderi*, but the marking of the face separates it. All these insects could be considered races of one species (*T. beccarii*). In the British Museum I find a series of *T. beccarii*, with the characteristic face-markings, but some (Karen, Abyssinia) have the scutellum practically all yellow, as in the

typical form, while others, after the manner of *T. topiorum*, have the anterior middle black. The latter are from Chiromo, Nyasaland (*R. C. Wood*). A specimen from Bianco, Belgian Congo, Aug. 8-11 (*J. O.*), agrees with *T. beccarii* as determined in the Museum; it has the scutellum practically all yellow, and the scape with a conspicuous light stripe in front. But one from Elisabethville (*L. O.*) has the scutellum margined with yellow, and the scape with a light stripe in front, not reaching apex; this is a form of *T. topiorum*. My cotype of *T. beccarii* has perfectly clear wings, and the stigma clear light red; in *T. alinderi* they are distinctly dusky. We thus appear to have a series of closely related forms, as in some of the South American *Melipona*, and perhaps it will be better to treat them as subspecies.

Anthidium capense Cameron.

Cape Province: Lady Grey, Dec. 1924, 2 ♀ (*R. J. Nel*).

Anthidium pontis, sp. n.

♂.—Length about 11.5 mm.

Broad and robust, black, with light yellow markings and white pubescence, stained with yellowish on head and thorax above; mandibles yellow with three black teeth; face narrow, orbits converging below, sides of face densely covered with long silky-white hair; clypeus dull, finely punctured, entirely light yellow, but supraclypeal area all black; pale yellow lateral marks cuneiform, filling space between eyes and clypeus, rounded broadly above, not going above level of antennæ; a small yellow spot above each eye; hair of cheeks pure white, contrasting with the yellowish of vertex; scape yellow in front, flagellum black; the third antennal joint has a very faint, hardly visible, dark red spot; a large light yellow patch behind and between ocelli, touching all three, and with a perfectly straight margin behind; mesothorax and scutellum dull, with short silky hair; prothorax dark except for the yellow tubercles; a slender line along each lateral border of mesothorax, failing anteriorly; a rather narrow yellow band bordering axillæ and scutellum, interrupted in middle of latter; axillæ and scutellum unmodified; tegulæ with a large

dark brown spot, surrounded by light yellow, and the margin hyaline. Wings greyish; first recurrent nervure received near base of second cubital cell, second recurrent meeting outer intercubitus. Femora black; anterior and middle tibiae yellow on outer side, hind tibiae with a very large basal yellow mark, shaped like a spear-head; basitarsi densely clothed with pure white hair, middle pair yellow on outer side; claw-joints red at end; no pulvilli. Abdomen with entire light yellow bands on all the tergites, the third to sixth somewhat notched at extreme sides; first tergite yellow, strongly stained with ferruginous, the hind margin black (the black broadest in middle) on all the tergites; sixth tergite angulate-subdentate at sides; seventh yellow, rather narrowly edged with black, with a median brown keel, the margin forming two very broad rounded lobes, with a small tooth between; beneath, there is a prominent black tooth at each side; venter clear ferruginous, base of sixth sternite broadly black except in middle, the long black teeth are on the sides of this sternite.

S. Rhodesia: Beit Bridge, April 12 (*Alice Mackie*).

A distinct and peculiar species, apparently allied to the European *A. diadema* Latr., but with much broader apical lobes and many other characters.

Anthidiellum medionigrum, sp. n.

♂.—Length about 5.5 mm. (with abdomen curved downward), anterior wing nearly 5 mm.

Black, with light yellow markings, which include mandibles (except teeth), the broad clypeus (except light reddish lower margin), a large square patch beneath each antenna (but middle of supraclypeal region black), lateral face-marks (filling space between clypeus and supraclypeal patches and eye, rather narrowly rounded above), a broadly interrupted stripe on occipital margin, very small spot on tubercles, small spot on axillae, broadly interrupted band on hind margin of the projecting and emarginate scutellum; large mark at each side of first tergite, larger and more elongated ones on second, still longer marks (but slender with enlargements mesad) on third, two large sublateral transverse marks on fourth; fifth, sixth, and seventh pale yellow, black only at sides

and very narrowly along margins; apex not dentate; face, front, cheeks, and sides of thorax with white hair, thorax above with extremely scanty dark hair; antennæ slender, shining black; mesothorax and scutellum dull and granular; tegulæ large, punctured, very dark, with reddish boss and margin. Wings dark greyish; basal nervure meeting nervulus; second recurrent nervure going as far beyond outer intercubitus as first is beyond base of second cubital cell. Anterior femora and tibiæ red in front, and apical half of femora dark red above; middle and hind femora with a red shade above, not reaching base; middle tibiæ red in front; anterior tarsi red, but middle and hind basitarsi cream-colour on outer side; pulvilli distinct.

Natal: Amanzimtoti, Oct. 16 (*W. P. Cockerell*).

Recognized by the entirely light yellow clypeus and the supraclypeal area black in middle. The abdominal markings are paler and less developed than in *A. compactum* (Sm.).

Anthidium niveocinctum Gerstaecker.

Portuguese E. Africa: Porto Amelia, June 7, both sexes (*A. M.*).

Widely distributed, to Lake Nyasa and Old Calabar.

Megachile edwardsi Friese.

S. Rhodesia: Vumba, Umtali, May 23-26, ♀ (*J. O.*).

This agrees with Friese's description (his type from Barberton), but I do not understand why he compares it with *M. lagopoda* (L.); it is actually extremely similar to *M. fulva* Sm., but quite distinct. In Friese's table it runs out at 21, having fulvous tegulæ and black legs. The broad hind basitarsi readily distinguish it from *M. dorsata* Sm. A characteristic feature, cited by Friese, is the depression or dimple in the middle of the clypeus.

Megachile (Eumegachile) leucospila, sp. n.

♀.—Length about 14 mm.

Black, head and thorax with scanty black hair, shining greyish white on under side of thorax, and whitish at end of tubercles; wings very dark fuliginous; mandibles, antennæ, and legs black; tarsi with red hair on inner

side, very bright on hind basitarsi, which are quite narrow; abdomen above densely covered with very bright red hair, except that the sides of first tergite are broadly pure white and a little white at extreme sides of second; scopa deep red, white at base.

Aspect of *M. rufiventris* Guér., but rather smaller; mandibles the same; facial structure almost the same, but ridge above clypeus not so wide, seen from above shining and obtusely angular; mesothorax and tegulae the same; hind femora with very thin white hair; hind tibiae with hair more or less pale; anterior and middle tarsi with pallid reddish hair.

Transvaal: Louis Trichardt, April 4–10 (*J. Ogilvie*).

On account of the white hair at sides of first tergite, this resembles *M. chrysorrhæa* Gerst., but the facial structure is more like that of *M. rufiventris*.

Megachile (Eumegachile) atopognatha, sp. n.

♀.—Length about 16 mm.

Black, rather more slender than the last; head with very scanty black hair; mandibles, antennae, tegulae, and legs black; thorax above with thin black hair, but at sides and behind with white; large tufts of dense pure white hair in region of tubercles and behind wings; wings dark fuliginous; legs with thin white hair, red on inner side of tarsi; hind basitarsi little broadened; abdomen mainly bare and shining; dense white hair at sides of first tergite; narrow bands of red hair on margins of fourth and fifth; more than apical half of fifth with short red hair; apical tergite with short coppery-red hair, except at base; scopa shining white as far as base of third sternite, after that red.

Aspect of *M. chrysorrhæa* Gerst., with the facial structure nearly the same (but with a shining supra-clypeal keel), but easily separated by the very long mandibles, which have a tubercle on inner side near base, and are strongly curved to end in a broad striate apex, which has only two feeble teeth, but the angular inner expansion is ornamented with about four parallel shining ridges. The cheeks are very broad, and the mesothorax is polished, with weak punctures.

S. Rhodesia: Shangani, De Beers Ranch, May 8–12 (*J. Ogilvie*).

Megachile andersoni Cockerell.

This was described (1930) from Tanganyika Territory, only the female being known. The male before me agrees so closely in a number of features that I believe it to be the same species. The special points of agreement include the darkened wings, with the characteristic dark band along the upper side of the basal nervure; the red mark on the tegulæ; the long white hair on cheeks; the tuft of black hair at sides of prothorax; the black hairs on scutellum, &c. The special characters of this male are:—

Length nearly 14 mm.

Parallel-sided; face and entire clypeus densely covered with pure white hair; mandibles strongly tridentate, black, obscurely rufescent subapically, beneath near base with a long sharp spine; antennæ long, entirely black; mesothorax dullish, not nearly so rough as in female; thorax posteriorly with long pure white hair and a tuft of the same on tubercles; scutellum with black hair, but long white hair just behind; mesothorax with very scanty white hair and a little black intermixed; legs dark brown, the femora more nearly black; anterior coxæ with long stout black spines; anterior tibiæ in front, and femora beneath, chestnut-red; anterior tarsi hardly modified, but thick, with a long dense white fringe behind; middle basitarsi with dense white hair on outer side and long white hairs behind; hind basitarsi with bright orange-ferruginous hair on inner side; first tergite with white hair, thin in middle, dense at sides; second to fourth with weak deciduous reddish hair-bands, on second broader and white at sides; fifth and sixth tergites covered with bright ferruginous hair; sixth and margin of fifth with the tegument red; keel of sixth broadly shallowly emarginate, not dentate; venter with three white hair-bands; a red spot at extreme sides of second and third sternites.

S. Rhodesia: Shangani, De Beers Ranch, May 8–12 (L. O.).

This agrees very nearly with the description of male *M. nasalis* Smith (*volkmanni* Friese), but Friese, in his table, states that the mandibles are unarmed at base below, and the anterior tarsi are not fringed. There is also some resemblance to *M. luangwæ* Meade-Waldo,

but this has only the apex of clypeus white-haired and the coxal spines short and slender. It is very close to *M. mesoleuca* Ckll., from the Belgian Congo, and I am not sure that it is more than a race or variety of that species. *M. mesoleuca*, based on the male, was published in 1931; if it proves that it and the above-described male are forms of *M. andersoni*, the latter name has priority.

Megachile flavida Friese.

S. Rhodesia: Shangani, De Beers Ranch, May 8-12 (J. O.).

Three females, and with them a male which evidently belongs to the same species. But this male is not at all the same as the one which Friese (with doubt) assigned to *M. flavida*. It is almost identical with *M. tarsisignata* Ckll., having the same sort of anterior legs. Compared with the type of *M. tarsisignata* (from Natal), it is larger (length about 12 mm.) and the transverse keel of sixth tergite is more produced, much more deeply incised, and its margin is not dentate. The hind basitarsi are much more robust, largely bare and shining on outer side, and the hair on the clypeus is pure white. I conclude that *M. flavida* and *tarsisignata* are one species, but the typical form of the latter will rank as a subspecies, *M. flavida tarsisignata*.

LI.—*Kingdonella wardi*, gen. et sp. n., a new Grasshopper (Orthoptera, Acrididæ) from the Assam Himalayas.

By B. P. UVAROV, British Museum (Natural History).

THE following new grasshopper was collected by the well-known explorer Mr. F. Kingdon Ward in the alpine regions of the sources of Irrawadi River. Although representing a hitherto-undescribed genus, it is closely allied to *Podisma* and must be regarded, therefore, as a further evidence of the south-western extension of the Palearctic fauna*.

* For a discussion of this zoogeographical problem, see my papers: (1) "*Podisma kingdoni*, sp. n.: a Contribution to the Zoogeography of the Himalayas," Ann. & Mag. Nat. Hist. ser. 9, vol. xx. 1927, p. 481; (2) "Second Species of the Palearctic Genus *Podisma* found in Assam," loc. cit. ser. 10, vol. v. 1930, p. 561.

KINGDONELLA, gen. nov.

Allied to *Podisma*, but differing in the pronotum flattened above and provided with distinct lateral keels.

Antennæ filiform. Face in profile moderately oblique in the ♂, vertical in ♀. Vertex sloping, distance between eyes greater than the width of the frontal ridge. Pronotum short, flattened above; transverse sulci distinct, dividing the disc into three equal sections; median keel low, linear; lateral keels irregular, thick throughout, gradually divergent backwards. Prosternal tubercle low, conical. Mesosternal lobes strongly transverse and separated by a transverse interspace even in the male. Mesonotum, metanotum, and the first abdominal segment in the female swollen. Tympanum very small, functionless. Elytra and wings absent. Front and middle femora incrassate. Last tergite of the male with a furcula; supra-anal plate triangular, with a pair of sublateral projections on the disc; cerci short, conical. Lower valvæ of the ovipositor short, curved, with a blunt basal tooth.

Kingdonella wardi, sp. n.

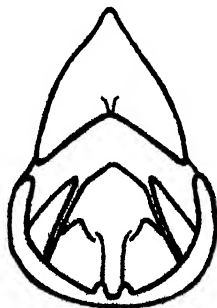
♂ (*type*).—Antennæ fairly stout, a little longer than head and pronotum together. Frontal ridge practically parallel-sided; surface shallowly sulcate almost to the clypeus; margins thick, smooth. Fastigium of vertex sloping, elongate, concave, not separated from the frontal ridge; margins thick, shiny, almost parallel. Eyes relatively small; the height of an eye is less than the subocular distance. Ocelli present.

Pronotum with the disc about half again as long as it is broad behind; surface slightly concave. Anterior margin broadly bi-convex, notched in the middle; posterior margin shallowly excised. Median keel low and thick, smooth. Lateral keels swollen, smooth. Metazona of the disc more than twice as broad as long, wrinkled close to lateral keels. Lateral lobe very smooth in prozona, finely rugulose, but shiny, in metazona; prozona above the middle with an oblique swelling.

Last tergite with the teeth of the furcula short. Supra-anal plate elongate-pentagonal, with a pair of flat triangular sublateral projections; median sulcus broad,

but developed only in the basal half. Cercus a little shorter than supra-anal plate, conical. Subgenital plate acutely pyriform.

General coloration brownish olivaceous, dull above, very shiny on the sides. Face, margins of fastigium, pronotal lateral keels, and front legs suffused with red. Hind femur dark reddish brown above; outer face yellowish olivaceous, blackened along the upper edge, particularly towards the apex; lower outer sulcus, lower inner sulcus, and the inner face bright red, with a black suffusion in the apical half. Hind knee olivaceous, suffused with red. Hind tibia above bright red, below black except the base and the apex.



Kingdonella wardi, gen. et sp. n.

End of the male abdomen.

♀ (*paratype*).—More robustly built than the male, and having a peculiar appearance owing to the distinctly inflated mesonotum, metanotum, and the base of abdomen. Lateral pronotal keels less swollen than in the male, but distinct. Disc of pronotum feebly convex. Coloration somewhat greyish olivaceous.

Length of body, ♂ 18, ♀ 21; pronotum, ♂ 4, ♀ 5; hind femur, ♂ 9, ♀ 10.5 mm.

Described from 6 ♂♂ and 8 ♀♀ taken in Tibet, in the region of the sources of Irrawadi River, 28° 25' N., 97° 55' E., 10,000–12,000 ft.

This curious insect exhibits some superficial resemblance to members of the genus *Dicranophyma*, but the structure of prosternal tubercle in that genus is very distinct.

LII.—*Further Coleoptera from the Galapagos Archipelago.*

By K. G. BLAIR, B.Sc., F.E.S., Deputy Keeper of the Department of Entomology, British Museum (Natural History).

IN the 'Annals and Magazine of Natural History,' ser. 10, vol. i. pp. 671–680 (1928), I dealt with certain groups of beetles from the Galapagos Islands collected by the members of the 'St. George' Expedition, 1924. The remainder of the beetles collected by the Expedition in that Archipelago have since remained unworked, and a further collection from the same group of islands, made by Mr. G. Bateson in the following year, having been presented to the National Collection the object of the present paper is to clear up this unworked material. That this should be done is rendered further desirable by the fact that Professor E. C. Van Dyke is now actively engaged in working out the rich collection made in the same region by the expedition of the California Academy of Sciences between Oct. 1905 and Sept. 1906. In the preparation of this paper I have had the double advantage of being able to examine a selection from this collection brought over by Dr. Van Dyke for comparison with the types contained in the British Museum, and of much personal help from him and discussion on points of difficulty. In certain cases where the California Academy collection contains long series from the different islands of species but meagrely represented in the material before me, and Dr. Van Dyke is thus in a much better position to deal with them than I am, I have left the description of new species in his more capable hands.

It is noteworthy that in Mr. Bateson's collection all the specimens labelled "Chatham Island" are new records from the Galapagos Archipelago, and none of them are represented in the California Academy collection, but all are either identical with or very closely related to known Panama species, a country in which Mr. Bateson also collected; to my mind it seems most probable that this fact is due to an error in labelling the specimens, most likely when being mounted after receipt by the Museum. That such an error should have occurred is most regrettable; for the present I have given these species the benefit of the doubt, but these

records from Chatham Island should be regarded with suspicion. Other species are labelled "Franklin Lake," a locality which I have been unable to locate; it is probable, however, that it is on Chatham Island, particularly as nearly all the aquatic species in Dr. Van Dyke's material are from Chatham Island.

In this paper, except in the case of species here described as new, I make no reference to the localities as given by Dr. Van Dyke's material, which only represents a fraction of the entire Academy collection. Unless otherwise stated Mr. G. Bateson is the collector throughout.

As a complete Bibliography of the literature dealing with the beetles of the Galapagos Islands is given by Mutchler, 'Zoologica,' v. no. 20, 1925, I refrain from needless repetition of references here, the only subsequent work dealing with them being, so far as I know, my paper quoted above.

Family Carabidæ.

Calosoma howardi Linell.

James Id., 22 ex.; Charles Id., 3 ex.; Albemarle Id., 2 ex.; Eden Id., 7 ex.

It is strange that this species found so commonly by Mr. Bateson was not taken by the collectors of the 'St. George.' The different forms of *Calosoma* found in the Archipelago will be discussed in detail by Dr. Van Dyke.

Selenophorus obscuricornis G. R. Waterh.

James Id., 1 ex.

Though placed by Mutchler in *Amblygnathus*, the species is an undoubted *Selenophorus*.

Pterostichus sp.

James Id., 14 ex.

This species, which is unlike any of those of G. R. Waterhouse, will shortly be described by Dr. Van Dyke.

Family Hydrophilidæ.

Tropisternus lateralis F.

Charles Id., 4 ex.

Though no locality was given on Darwin's specimens,

the species was collected by Capt. Cookson of H.M.S. 'Peterel' on Charles Id.

Enochrus waterhousei, sp. n.

Fulvo-testaceous, more or less clouded with fuscous on the dorsum; head black with a large fulvous patch on each side of the clypeus; palpi and legs fulvous. Head finely, not very closely punctured, with a group of large punctures on each side between the eyes; clypeal suture feeble. Pronotum punctured as finely as and rather more remotely than the head, with an oblique line of larger punctures on each side near the anterior margin. Elytra punctured as the thorax with three lines of larger punctures; sutural stria strong, reaching to basal third of elytron. Underside and femora, except at apex, blackish. Median carina of prosternum well developed, mesosternal lamina high and subrectangular at apex.

Length 4 mm.

Franklin Lake, 17 ex.

Closely allied to the Central American *E. æqualis* Shp., but differs in its rather more elongate form, in the scarcely evident clypeal suture, the pale legs, etc.

Enochrus obscurus Shp.

Sharp, Biol. Centr.-Amer. i. 2, p. 69 (1882).

Philhydrus sp. G. R. Waterhouse and C. O. Waterhouse.

Charles Id., 6 ex.

The short series agrees better with Sharp's second and smaller example than with the type, but I cannot find that it differs specifically. From *E. galapagoensis* it differs in having the prosternum simply convex instead of medially carinate and the median elevation of the mesosternum low and obtuse, not elevated into a vertical plate.

Although C. O. Waterhouse lists this species under "Islands not specified," Darwin's original specimen bears a label "Charles Isld.," with the no. 3364 on the reverse side.

Ochthebius batesoni, sp. n.

Small, brownish, head and thorax strongly metallic with varied greenish and coppery tints; upper surface

sparsely clothed with fine whitish depressed hairs; palpi and legs flavous. Head with two strong foveæ. Thorax moderately transverse, the white waxy margin almost complete; disc with a median sulcus reaching neither base nor apex and interrupted just behind the middle; on each side of it is a small elongate fovea near the anterior margin, and a similar but larger fovea before the base, these pairs connected transversely by a shallow depression; near each anterior angle is a large oblique impression; disc moderately strongly but rather unevenly punctate. Elytra elongate-ovate, widest about the middle; punctures of striae large and round, rendering the intervals narrow, scarcely as wide as the punctures.

Length 1.6 mm.

Loc. Franklin Lake, 1 ex.

Allied to the European *O. marinus* Payk., but rather smaller and paler, the thorax less transverse, with feebler transverse impressions; the puncturation of the elytra is very different. Of the species described by Sharp in the 'Biologia Centrali-Americana' it resembles only *O. aztecus*, in which, however, the thorax is less transverse, the median sulcus entire, the punctures of the disc much finer and sparser; the punctures of the elytral striae are also finer, distinctly narrower than the intervals, and the upper surface is less obviously pubescent.

Cœlostoma darwini, sp. n.

Moderately convex, somewhat depressed on dorsum, oblong-elliptical, moderately nitid, piceous-black, with mouth-parts and antennæ fusco-testaceous. Head finely and rather densely punctate, the punctures becoming finer anteriorly. Thorax rather evenly and densely punctate, the sides strongly marginate, the margin running round the anterior angles but widely interrupted in the middle of the anterior border, and also round the posterior angles but scarcely beyond; base feebly bisinuate. Scutellum elongate-triangular with apex rounded, base about $\frac{3}{4}$ as long as median length. Elytra parallel for about $\frac{1}{4}$ of their length, the base bordered nearly to scutellum; sutural stria abbreviated in front at about $\frac{1}{4}$, sutural interval rather broad, multipunctate; disc densely and evenly punctate, non-striate, but the positions of the striae feebly indicated by rows of slightly larger, widely

spaced punctures. Prosternum obtusely tectiform but not costate, and first abdominal segment evenly but feebly convex.

Length 7 mm.

Loc. Charles Id., 2 ex.; James Id., 1 ex.; Indefatigable Id., 1 ex.; all at light (*C. L. Collenette*); Abingdon Id. (California coll.).

In size and shape suggests a *Ductylosternum* resembling *subdepressum* Cast. rather than a *Caelostomu*, but lacks the carinate prosternum and first abdominal segment of that genus; the elytra also are confusedly punctate without distinct striae.

Family Histeridae.

Saprinus batesoni, sp. n.

Nitid, black, with faint æneous tinge, elytra very obscurely reddish; mouth-parts, legs, and antennæ reddish. Head densely and strongly punctate, no carina separating clypeus from frons. Thorax finely and sparsely punctate in middle, the punctures becoming coarser and more elongate towards sides, but again finer but denser close to the margins, no distinct belt of large punctures at base. Elytra punctured throughout, but punctures fine and sparse towards base and sides; sutural stria not reaching apex and abbreviated at basal third; first three dorsal striae subequal, reaching a little beyond half the length of the elytra, the internal bent inwards at base to form an interrupted arch with the sutural, 4th (outer) dorsal stria rather longer, with a short supplementary stria close to it; lateral, subhumeral, stria concurrent with lateral border, with a short secondary stria given off from its base.

Length 3.4 mm.

Loc. Eden Is. (type); Franklin Lake, 1 ex.

Resembles the S. American *S. modestior* Mars. in most details, but in that species the union of sutural and first dorsal striae is complete and the uniting arch punctate, whereas in the Galapagos species the basal portion of the first dorsal stria is impunctate. Of the Central-American species it most resembles *S. quassitus* Lew., but the prosternal striae are divergent and well down the sides of the median ridge, whereas in *quassitus* they are approximate and on the top of the ridge; the transverse

prolongation of the first dorsal stria is punctate and there is a band of large punctures across the base of the thorax.

Family **Coccinellidæ**.

Scymnus galapagoensis G. R. Wat.

Narborough, 3 ex. beaten from mangroves (*Collenette*).

Family **Languridæ**.

Camptocarpus longicollis Mots.

Gorham, Biol. Centr.-Amer., Col. vii. 1887, p. 6, pl. i. figs. 1-2.

Chatham Id., 1 ex.

A Central and South American species of fairly wide distribution (perhaps introduced).

Family **Dermestidæ**.

Dermestes vulpinus F.

James Id., Indefatigable Id., 3 ex. from each.

Family **Scarabæidæ**

Atcenius cribrithorax Bates.

James Id., 13 ex.

A Central-American species, perhaps introduced.

Family **Bostrychidæ**.

Schistocerus galapaganus Lesne.

Charles Id., 1 ex.

Family **Lyridæ**.

Calocladon testaceum Gorh.

Gorham, Biol. Centr.-Amer., Col. iii. 2, 1881, p. 28, pl. ii. fig. 20.

Chatham Id., 1 ex.

The single example agrees well with the type from Nicaragua, except that the shank of each joint of the antenna is a little more produced on the inner side.

Family **Cantharidæ**.

Chauliognathus sulphureus C. O. Waterh.

Waterhouse, Trans. Ent. Soc. London, 1878, p. 321; Champion, *ibid.* 1914, p. 154.

Chatham Id., 1 ex.

The single example is hardly mature, the antennæ and legs being dark testaceous instead of black, and the elytra slightly translucent. In other respects it appears to be inseparable from Central-American specimens. The type is from the Upper Amazon, Nauta.

Family **Cleridæ.**

Pelonium longfieldæ Blair.

James Id., 1 ex.

Necrobia rufipes DeG.

Indefatigable Id., 4 ex.

Family **Elateridæ.**

Physorhinus sp.

James Id., 3 ex. ; Albemarle Id., 1 ex.

These examples differ from the type of *P. galapagoensis* Waterh. in having the frons uniformly dark. They will be discussed by Prof. Van Dyke in relation with the longer series at his command.

Family **Tenebrionidæ.**

STOMION Waterh.

Three species of this purely endemic genus were described by G. R. Waterhouse, three others being subsequently added by Linell. The latter author, working only by descriptions, was able to identify only one of Waterhouse's species, and this apparently incorrectly, a specimen labelled *lævigatum* Wat., kindly sent me by Mr. Mutchler, being incorrectly determined. From Waterhouse's types now before me and paratypes of two of Linell's species, I am inclined to recognize four species with distribution as follows :—

1. *galapagoensis* Waterh..... Charles Id. (*Darwin*, *Collenette*, 18 ex. ; *Bateson*, 1 ex.).
 ♂ = *carinatipennis* Linell Charles Id.
 ♀ = *piceum* Linell Charles Id. (*Chatham Id.* of Linell).
2. *helopoides* Waterh. (Loc. not stated.)
3. *lævigatum* Waterh. (Loc. not stated.)
 Charles Id. (*Collenette*, 2 ex.) ;
 James Id. (*Bateson*, 10 ex.).
- ? = *bauri* Linell, ex. descr. ... Albemarle (*Collenette*, 5 ex.).
4. **MUTCHLERI**, sp. n. (*lævigatum* Linell, nec Waterh.). Tower Is. (1 ex. det. Mutchler) ;
 Indefatigable Id. (3 ex., *Collenette*) ; Eden Id. (4 ex., *Bateson*).

These may be separated by the following key :—

- | | |
|---|--------------------------|
| 1 (4). Thorax and elytra distinctly and strongly punctured | 2. |
| 2 (3). Size larger (8½–11 mm.), surface more opaque, elytral striae regular and sulcate, thorax widest at base | <i>galapagoense</i> Wat. |
| 3 (2). Size smaller (7–8 mm.), more shining, thorax widest behind middle; elytral striae less regular, feebly impressed | <i>helopoide</i> Wat. |
| 4 (1). Thorax and elytra finely punctured, punctures of elytra often hardly discernible; striae not sulcate (7–8 mm.) | 5. |
| 5 (6). Narrower, more oblong; thorax widest behind middle, sides rounded | <i>laevigatum</i> Wat. |
| 6 (7). Broader, more ovate; thorax widest at base, arcuately narrowed to front; anterior angles acute | <i>linelli</i> , sp. n. |

Stomion linelli, sp. n.

Pitchy black, subopaque; head more strongly and closely punctate than thorax, the latter widest at base, the sides feebly arcuate, slightly sinuate in front, with the anterior angles acute and prominent; disc finely and sparsely punctate with the interspaces alutaceous. Elytra shortly ovate, wider than the thorax, their greatest width at about their posterior third; striae faintly indicated, their punctures widely separated and but little larger than those of the intervals; apex angulate.

Length 7–8 mm.

Eden Id., 3 ex. (*Bateson*); Indefatigable Id., 3 ex. (*Collenette*); Tower Is. (1 ex. det. by Linell as *laevigatum* Waterh.). Also in the California Academy collection.

Resembles *S. laevigatum* in sculpture but of much broader build, widening gradually from in front to the posterior third of the elytra. In *laevigatum* the thorax is but little wider at the base than at the apex, and the elytra widest about the middle, giving the insect a more elongate subparallel form rather than the obovate form of *linelli*.

Ammophorus obscurus G. R. Waterh.

James Id., 12 ex.; Eden Id., 4 ex.

Ammophorus cooksoni C. O. Waterh.

Charles Id., 2 ex.

Pedonæces galapagoensis G. R. Waterh.

James Id., 3 ex.

Pedonæces costatus G. R. Waterh.

James Id., 1 ex.

The type bears a label "3365" on one side and "James Id." on the other, a locality which was omitted from the original description.

Pedonæces morio Boh.

James Id., 1 ex. determined from description.

Pedonæces lugubris Boh.

Eden Id., 9 ex. ; Indefatigable Id., 1 ex.

Determined from description. The locality given by Boheman is Panama, but I know nothing like it from Panama and suspect an error.

Pedonæces batesoni, sp. n.

Oblong, black, subglabrous, opaque, finely punctured on a dull alutaceous ground. Head, thorax, and elytra similarly punctured, each puncture with a fine decumbent hair visible only under fairly high magnification. Elytra narrower at the base than base of thorax, widest a little behind the middle; punctures of striae fine, though a little larger than those of the intervals; intervals obtusely costiform, the 1st, 3rd, 5th, etc., more strongly, raised towards the apex.

Length 6 mm.

Eden Id., 2 ex.

Resembles *P. morio* Boh., but has the thorax very much more finely and sparsely punctate, the striae of the elytra more finely punctate, and the intervals differently costate; in *P. morio* the striae are in wide rounded troughs with sharp crests between them, whereas in the new species both troughs and crests are obtusely angular.

The six species ascribed to this genus may be differentiated as follows:—

- 1 (2). Body with moderately long decumbent pubescence..... *pubescens* W.
- 2 (1). Body glabrous or subglabrous.
- 3 (4). Elytral intervals convex; punctures of striae large, rather irregular in size; surface moderately nitid *galapagoensis* W.

- 4 (3). Intervals costiform.
 5 (6). Alternate intervals strongly costiform;
 thorax densely rugose-punctate *costatus* W.
 6 (5). All intervals raised; punctures of thorax
 not rugose, at least in middle.
 7 (10). Puncturation of thorax much coarser than
 of elytral intervals; costæ well elevated,
 moderately sharp.
 8 (9). Size larger (9 mm.); costæ very narrow... *lugubris* Boh.
 9 (8). Size smaller (6 mm.); costæ nearly as wide
 as intervening troughs *morio* Boh.
 10 (7). Puncturation of thorax similar to that of
 elytra, punctures of striae also fine; costæ
 low and obtuse *batesoni*, sp. n.

Rhacius costipennis, sp. n.

Elongate, parallel, dark castaneous, subnitid. Thorax feebly transverse, widest in front, sides nearly straight, feebly sinuate before anterior and posterior angles. Elytra more than twice as long as head and thorax together; punctures of striae broad, transverse, leaving narrow carinate intervals; humeri shortly rounded. Posterior femora very obtusely dentate on anterior lower edge; intermediate femora unarmed.

Length $8\frac{1}{2}$ mm., width $2\frac{1}{2}$ mm.

James Id., 1 ex.

Differs from the Central and South American *R. sulcatulus* Champ. in its narrower form, definitely costate elytra, and slight development of femoral teeth.

Family Cistelidæ.

Cteis pedinoides Mäkl.

Champion, Biol. Centr.-Amer. iv. 2, 1888, p. 465, pl. xxi. fig. 13.

Chatham Id., 1 ex.

I cannot see that this specimen differs from examples from Panama and Columbia.

Family Edemeridæ.

Alloxaxis collenettei Blair.

Albemarle Id., 4 ex.

Family Cerambycidæ.

Eburia lanigera Linell.

James Id., Eden Id. (1 ex. from each, determined from description).

This appears to me to be only a variety of the Central-American and West-Indian *E. stigma* Oliv. Linell made no comparison with this species nor gave any indication of its position in the genus. Both Mr. Bateson's specimens have much shorter apical spines on both femora and elytra than normal *E. stigma*.

Eburia proletaria Fr.

Ericson, Arch. für Naturgesch. xiii. 1847, i. p. 140.

Albemarle Id., Tagus Cove, 1 ex. at light (*C. L. Collette*).

The single specimen appears to agree in all essentials with examples from Peru. This makes the fourth species of *Eburia* to be recorded from the Galapagos.

Compsa apicalis, sp. n.

Reddish testaceous, with moderately dense decumbent silvery pubescence; elytra with a roundish or cordiform spot on each before the middle and the apex rather broadly flavous. Antennæ with basal joint constricted near base, the 3rd and following not carinate. Thorax elongate, closely and finely punctate and pubescent, with a median elevation. Elytra less closely punctate, the punctures round and of two distinct sizes; in addition are a few large punctures or pores, set obliquely in the surface, the anterior rim raised and thus asperate, each with a long central bristle; apex obliquely truncate, not spinose; the pale spots are all surrounded by a broad dark rim, the anterior border of the apical spots arcuate. Femora unarmed at apex, the posterior extending slightly beyond apex of abdomen.

Length 6 mm.

James Id., 1 ex. (*Collette*).

In facies resembles *C. quadrimaculatum* F., but is rather less elongate, particularly the thorax, has a different arrangement of the elytral markings and the setigerous pores much larger and more prominent. A specimen from New Grenada (Fry Coll., ex Mus. Laferté) is probably the same species, but is 12 mm. in length. A second specimen, otherwise similar to the last, has the apical spots of the elytra much smaller and separated from all margins.

Desmiphora hirticollis Oliv.

Bates, Biol. Contr.-Amer. v. p. 116 (*D. mexicana* Thoms.).

James Id., 1 ex. at light (*C. L. Collenette*).

A widely distributed Tropical-American species occurring from Mexico and the West Indies to the Argentine.

Estola galapagoensis, sp. n.

Moderately elongate, parallel, dark castaneous-brown, covered with a moderately dense but irregular decumbent ashy-grey silky pubescence.

Head rather broad, eyes coarsely faceted, the lower lobe a little wider than high. Antennæ moderately long, fringed with long hairs beneath on 3rd and 4th joints and with a few long hairs on the next three, each joint with a narrow basal belt of pale pubescence; 3rd joint slightly longer than the 4th, apex of 8th joint in ♂ or 10th in ♀ reaching apex of body. Thorax finely punctulate and pubescent, with a median line in basal half smooth and bare; there are, in addition, a number of large irregularly spaced punctures on the basal half, but very few on anterior half. Scutellum densely pubescent with bare median area not reaching apex. Elytra indistinctly maculate, owing to the depressed pubescence lying rather unevenly tending to form lighter lines and spots where denser and leaving dark patches where thin or absent; there are also larger punctures, each with a long backwardly directed seta, irregularly scattered but larger and more numerous towards the scutellum; apices rounded.

Length 12-17 mm.

James Id., 4 ex.; Indefatigable Id., 1 ex. at light, sea-level (*Collenette*); Albemarle Id., 1 ex. in California coll.

Allied to the Central-American *E. perforata* Bates, which differs in the pubescence being browner and more evenly lying, thus giving a smoother appearance to the elytra, the maculations being due to dark colouring in the derm and in part to bare patches. The large punctures extend over the whole pronotum, and are much more prominent and more evenly distributed on the elytra. I follow Bates in retaining the species provisionally in this genus, Fairmaire's genotype being unknown to me.

Estola cribrata, sp. n.

Moderately elongate, dark reddish brown, thinly clothed with short decumbent white pubescence.

Head wide with frons somewhat convex longitudinally, with large not very closely placed punctures; pubescence rather short, depressed, with a few long erect setæ near the eyes and towards the vertex. Antennæ concolorous, rather short, not reaching apex of body, 3rd joint a little shorter than 4th, the latter nearly twice as long as 5th, the rest successively shorter; a thin fringe of not very long hairs on lower side. Thorax transverse, evenly convex above except for a rather strong depression before the base; lateral tubercles situated well behind the middle; disc coarsely rather evenly punctate, the interspaces about large enough to take another puncture, the punctures ovate, each with a white backwardly directed hair arising from its anterior border, but hardly larger than the depressed hairs of the interspaces. Elytra tapering slightly from the shoulders, punctured and pubescent much as the thorax but that the punctures along the middle of the disc form regular series; the setæ of the punctures are also larger and more erect. Underside with puncturation and clothing very similar to the upper side.

Length 6-7 mm.

Albemarle Id., 2 ex.

Of the Central-American species this most resembles *E. misella* Bates, but differs in the much greater distance separating the eyes (in this species nearly equal to the length of the scape, but only about half that distance in *misella*), in the broader and more evenly convex thorax, and in the sparse pubescence of the body.

Estola insularis, sp. n.

Resembles the foregoing, but reddish testaceous in colour, the antennæ paler, each joint with a fuscous band before the middle and another at apex, the thorax with lateral tubercles larger and basal depression scarcely indicated, the pubescence of thorax and elytra denser and forming small pale maculations here and there; the tibiæ with indistinct dark bands, one at the base and one just beyond the middle.

Indofatigable Id., 1 ex. (C. L. Collenette).

Family Chrysomelidae.

Metachroma labrale, sp. n.

Oblong, convex, shining, dark pitchy brown, the elytra paler posteriorly, the labrum, palpi, antennæ, and legs reddish testaceous. Vertex and front of head rather coarsely punctate and alutaceous between the punctures, the part between the upper lobes of the eyes more shining and more finely punctate; vertex with a median smooth carina, frons with a small fovea; labrum large, elevated, almost covering the jaws, about one and a half times as wide as its median length, anterior border depressed with a pair of setigerous pores above the depression. Thorax half as wide again as long, rather feebly and sparsely punctate, all angles dentiformly produced laterally. Elytra a little wider at base than thorax, widest at two-thirds of their length; punctures of striæ distinct to apex, not very closely placed, very much narrower than the intervals, striæ regular, even the two short posthumeral, but somewhat confused near apex; intervals flat, rather sparsely punctate, convex towards apex. Propleuræ alutaceous, impunctate. Abdomen alutaceous, coarsely punctate in middle but more finely towards sides. Posterior femora with a very small but sharp tooth beneath. Tarsal claws with a small sharp tooth on inner side at base.

Length 7 mm.

James Id., 1 ex.

Of the Central-American species this most closely resembles *M. variabile* Jac., but the latter is smaller and less nitid, with the elytral punctures and striæ almost effaced near apex and with the labrum much smaller, the jaws projecting far beyond it. The inner branch of the tarsal claws is also much larger, about half as long as the outer.

Doryphora guerina Stål, var.

Stål, Öfv. Vet.-Ak. Förh. xiv. 1857, p. 54.

Chatham Id., 2 ex.

The two examples differ from others from the typical habitat, Columbia, in having the black transverse bands of the elytra less developed, being narrow, less sharply defined, and less markedly zigzag, the anterior band

narrowly interrupted on the suture, and the crimson marginal spots that terminate the yellow bands completely wanting. That there has been an error in labelling of this and the two following species appears to me probable, their real country of origin being Panama. There are, however, no specimens from Panama in the British Museum, nor is it recorded in the 'Biologia.'

Diabrotica ventricosa Jac.

Jacoby, Biol. Centr.-Amer., Col. vi. 1, 1887, p. 543, pl. xxxii. fig. 25.

Chatham Id., 1 ex.

This specimen appears to agree entirely with others collected by Champion in Panama, whence probably it really came.

Physonota alutacea Boh.

Champion, Biol. Centr.-Amer., Col. vi. 2, 1894, p. 166.

Chatham Id., 1 ex.

This also agrees with specimens from Panama, and its presence in the Galapagos Archipelago requires confirmation.

Family *Curculionidæ*.

Pantomorus galapagoensis Linell.

James Id., 17 ex.; Albemarle Id., 3; Charles Id. and Indifatigable Id., 1 each. The type-series was from Chatham Id.

This genus exhibits strong endemicity, or tendency to break up into species on the different islands. As, however, Dr. Van Dyke has much longer series from the different islands than it is now possible for me to examine, I will leave the description of these island-races and the discussion of their systematic status in his more able hands.

Anchonus galapagoensis G. R. Waterh.

James Id., 1 ex.

Geræus batesoni, sp. n.

Black, with legs and antennæ reddish, upper surface glabrous, underside clothed with broad closely adpressed pale scales each in a large puncture. Rostrum moderately long, curved, of even thickness, continuous with frons;

jaws meeting in a straight line; antennæ inserted laterally about the middle of the rostrum, the scape reaching nearly to the eye, scrobes running obliquely backwards and ventrally, funiculus 7-jointed, basal joint about as long as next two together, club ovate. Thorax but little broader than long, sides parallel in basal half, rounded and narrowed anteriorly with feeble and ill-defined collar; disc coarsely punctate, the punctures rather smaller and more widely spaced towards middle with finely alutaceous interspaces, larger and more or less confluent at sides, base broadly bisinuate. Elytra wider across the shoulders than the thorax, narrowing gradually backwards, conjointly rounded at apex leaving tip of pygidium exposed; striæ deep and sharply cut, the punctures scarcely encroaching upon the intervals, the latter flat, each with a fairly regular series of large punctures occupying the width of the interval, moderately deep on anterior side but shallow posteriorly. Prosternum not notably excavate, without precoxal spines; tibiæ feebly uncinatæ at apex; tarsal claws separate, rather slender.

Length (rostr. excl.) 3 mm.

Chatham Id., 1 ex.

The generic position of this species is somewhat doubtful. It would go into *Geræus* of the 'Biologia,' but not as restricted by Casey. In this author's key to the Brazilian genera of the Centrinini (Mem. 10, 1922) it seems to run down to 54, but will not fit into either branch of this. Of the 'Biologia' species it perhaps most resembles *G. rubritarsis* Champ., though this species is setigerous above and has, *inter alia*, a more slender funiculus and the elytra entirely covering the pygidium.

Dryotribus mimeticus Horn.

Horn, Proc. Amer. Phil. Soc. xiii. 1873, p. 433.

Thalattodora insignis Perk. Faun. Hawai. ii. 1900, p. 146.

Narborough, 3 ex. (*C. L. Collenette*).

An insect of interesting distribution. The British Museum series includes examples from Florida and the West Indies, China, W. Australia, and Hawaii.

Neopentarthrum towerensis Mutchl.

Franklin Lake, 1 ex.

Determined from description and figure.

Family Scolytidæ.

Pycnarthrum insulare, sp. n.

Flavous or brownish testaceous, clothed with moderately short erect pubescence. Thorax about as long as wide, moderately closely and evenly punctate, with a median line abbreviated both in front and near base free of punctures, the sides subparallel. Elytra wider than the thorax with finely punctured striæ, intervals not very closely punctulate, the punctures with a tendency to form a triple series on each; the punctures of the striæ either without or with very minute setæ, causing them to appear as narrow lanes in the erect pubescence of the surface.

Length 2-2.5 mm.

Albemarle Id., Tagus Cove, at light, 200 ft., and Charles Id., sea-level (both *C. L. Collenette*). Tower Id. and Hood Id. in California coll.

From the West-Indian *P. pallidum* Chap. it differs in its more quadrate less closely punctured thorax and in the very much more finely punctured striæ of the elytra and in the finer and more even pubescence of the intervals. In *P. pallidum* and in *P. lambottei* Chap. the punctures of the striæ are large and round, almost as wide as the intervals, and the median series of setæ on the intervals is much stouter and longer than the series on either side of it. The longer examples are rather more elongate than the shorter, a difference that is probably sexual.

It is probable that the single damaged Scolytid recorded by Linell from Charles Id. was this species.

LIII.—*Notes on a Collection of Polychæta from South Africa.* By C. C. A. MONRO (British Museum).

INTRODUCTION.

These worms were collected by Prof. T. A. Stephenson of the University of Capetown, and are part of his material for an ecological survey of the South African marine fauna. The majority were obtained at Stil Bay and Preekstoel, neighbouring localities, as measured on the map, about 80 miles east of Cape Agulhas.

The remainder came from St. James, False Bay, and Seaforth, also near Simon's Town.

I have very little data as to the differences in marine ecological conditions between the False Bay and Stil Bay regions. The following note on temperature was given to me by Mr. T. J. Hart of the 'Discovery' Investigations :—

"From Temperature charts, Meteorological Council, 1884. Official no. 59.

"Surface Temperature.

False Bay.		E. of Cape Agulhas.	
Feb.	66 F.	Feb.	69 F.
May	62 F.	May	64 F.
Aug.	59 F.	Aug.	62 F.
Nov.	62° F.	Nov.	64° F.

"All these values are probably too high, owing to the method of taking the temperature. The inshore surface temperatures on the coasts washed by both currents (Agulhas and Benguela) are lower than those offshore owing to upwelling of deep waters. N. and E. of Cape Agulhas there is a tiny counter-current very close inshore."

Gilchrist (1923, p. 13) quotes the temperature record made by the 'Pickle' on a voyage from Durban to Capetown :—"From Port Elizabeth to Cape Point it (the temperature) varied above and below 60° F., there being a drop of 5° F. off Cape Point." I think that one may take it that the Stil Bay waters are more influenced by the warm Agulhas current than those of False Bay, which must to some extent be modified by the cold Benguela current. So far as one can judge from the present scanty material, the Stil Bay Polychætes have more affinity with the Indian Ocean Polychæte fauna than have those of False Bay, which appear to belong rather to the "Cape" or Benguela current fauna. Thus *Pomatoleios crosslandi*, *Hydroides spinosus*, *Branchiomma quadrioculatum*, *Arabella mutans*, *Eunice filamentosa*, and *Bhawania cryptocephala* are tropical species. The true Cape Annelid fauna is a modified North Atlantic and Mediterranean fauna, but I believe that, except for the more or less cosmopolitan species like *Serpula vermicularis* and *Syllis variegata*, the number of species common to Europe and the Cape is small.

As one might expect in a collection of littoral forms such as this, normally accustomed to considerable changes in temperature etc., there is some overlapping between the False Bay and Stil Bay Annelid faunas. Actually in the present material there are only three species common to both areas—*Euphrosyne capensis*, *Lepidonotus semitectus*, and *Gunnarea capensis*,—but a number of the species here recorded from the Stil Bay region have previously been reported from the area covered by the Benguela current. Among these are *Nicolea macrobranchia* and the varieties of *Audouinia filigera*.

I have described one new species, *Perinereis falso-variegata*, and one new variety, *Glycera convoluta* var. *capensis*. I have also redescribed *Perinereis capensis* (Kinberg), which, I believe, has not been seen since its original record by Kinberg in 1865. *Perinereis falso-variegata* shows a type of variation which is exactly parallel with that of a number of other Nereids, and seems to constitute an example of an evolutionary trend.

SYSTEMATIC ACCOUNT.

Family Amphinomidæ.

Euphrosyne capensis Kinberg.

M'Intosh, 1903, p. 22.

Occurrence.—Stil Bay (2); Seaforth (1).

Remarks.—I cannot discover whether the *E. myrtosa* Savigny recorded by Ehlers (1913) from the Cape is the same as this species.

Family Polynoidæ.

Lepidonotus semitectus Stimpson.

Willey, 1904, p. 256, pl. xiii. fig. 4.

Occurrence.—Stil Bay (13); Seaforth (2); Preekstoel (1).

Polynoe scolopendrina Savigny.

Willey, 1904, p. 257, pl. xiii. figs. 5 & 25.

Fauvel, 1923, p. 80, fig. 30, a-k.

Occurrence.—Stil Bay (3).

Harmothoe waahli (Kinberg).

Augener, 1913, p. 112, pl. ii. fig. 9, with bibliography.

Occurrence.—Stil Bay (2).

Remarks.—The larger of these two specimens measures 20 mm. by 2 mm. without the feet for 42 chætigera. The head is very like that of the closely allied *H. spinifera*; it has widely separated pairs of eyes and the anterior pair is situated at the outer edges of the frontal lobes.

Fig. 1.

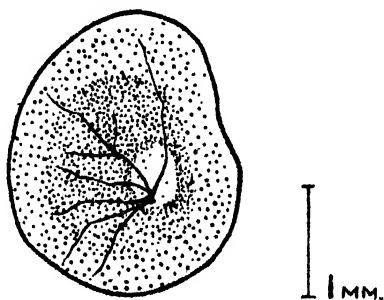


Fig. 2.

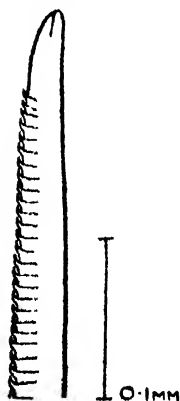
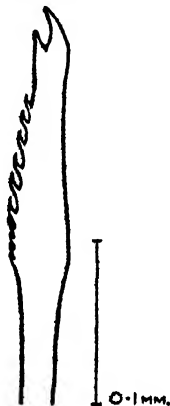


Fig. 3.



Harmothoe waahli (Kinberg).

Fig. 1.—Elytron.

Fig. 2.—Dorsal bristle.

Fig. 3.—Ventral bristle.

The appendages of the head are rather short. The median tentacle is about as long as the distance from the hinder border of the prostomium to the end of the median

tentaculophore; the lateral tentacles are about half this, and the thick palps are intermediate in length.

The scales (fig. 1) are greyish in colour, without a trace of fringing, and dotted all over with very small conical tubercles. Nerve-twigs are evident radiating from the scar of attachment.

The feet are of the usual harmothoid type, with a well-developed dorsal ramus. The dorsal bristles (fig. 2) are provided with rows of spinules, but these are not so strongly developed as in *H. spinifera*. The tip is smooth and in some of the bristles, but not in all, I can detect a small terminal groove similar to that in *H. spinifera*. The ventral bristles (fig. 3) are bidentate, and one in the middle of the series has about 12 frills of denticles. The dorsal cirri are about twice as long as the dorsal bristles, and the ventral are short and swollen proximally. Both tentacles and cirri are covered with exceedingly small clavate papillæ.

The last elytriphorous segment is the 11th from the end of the body.

This species is very close to *H. spinifera*, but differs chiefly in the smaller degree of pectination of the dorsal bristles. According to Augener it has been found off South Australia, New Zealand, and Kaiser Wilhelm II. Land. I regard it as the southern representative of *H. spinifera*. This is the first record from the Cape.

Harmothoe equisetæ Kinberg.

Augener, 1918, p. 137.

Parmenis capensis Willey, 1904, p. 258, pl. xiii. figs. 7 & 8, and figs. 27-29.

Occurrence.—Stil Bay (1).

Remarks.—I think it possible that the specimen from Simon's Town, attributed by Ehlers (1913, p. 446) to *Lagisca extenuata* (Grube), may belong here.

Family Chrysopetalidæ.

Genus BHAWANIA Schmarda.

Bhawania cryptocephala Gravier.

Gravier, 1901, p. 263, pl. x. figs. 152-156, text-figs. 280-285.

Occurrence.—Stil Bay (1).

Remarks.—This is the first record of this Red Sea and Indian Ocean species from the Cape. Potts records

it from Zanzibar. It is difficult to separate from the West Indian and West African *B. goodei* Webster.

Family Syllidae.

Syllis variegata Grube.

Fauvel, 1923, p. 262, fig. 97, h-n.

Occurrence.—Stil Bay (8).

Remarks.—These specimens seem to be unusually large examples of this cosmopolitan species. The largest measures 40 mm. by 2 mm. without the feet, and the number of articles to the dorsal cirri is very high. One of the longer dorsal cirri in the middle of the body has about 60 articles, and one of the shorter about 40 articles. The pharyngeal tooth lies at the end of the pharynx, and the latter extends to about the 15th chaetiger and the proventriculus to the 23rd. The bristles appear to be typical.

Ehlers (1913) records this species from the Cape, but Augener holds that his specimens should have been referred to *S. brachychæta* Schmarda.

Syllis brachychæta Schmarda.

Augener, 1918, p. 247, pl. iv. figs. 83-85, pl. v. fig. 98, text-fig. xx.

Occurrence.—Stil Bay (1).

Trypanosyllis zebra Grube.

Fauvel, 1923, p. 269, fig. 101, a-e.

Occurrence.—Stil Bay (4).

Remarks.—Four specimens, which I believe to belong to this northern and Atlantic species. The dorsal cirri are violet. The colour-bands on the back are narrower than in *T. tæniæformis*, which I regard as the southern representative of this species. The dorsal cirri are relatively shorter, being about equal to the breadth of the body, whereas in *T. tæniæformis* they are longer than this. Moreover, I believe *T. tæniæformis* to be a rather larger species.

Family Nereidae.

Perinereis falsovariegata, sp. n.

Occurrence.—Preekstoel (1).

Description.—A ripe female, filled with eggs but quite unmodified. The specimen measures 18 mm. by 1 mm., without the feet, for about 60 chætigers. The colour in spirit is a very pale yellow with some brown markings on the prostomium. The head is about as long as wide and narrows rather sharply in front. The slender tentacles reach to the end of the palpophores, which carry small conical palps. The longest tentacular cirrus reaches to the 7th chætiger. The jaws are toothed over their whole length. Group I. has a single paragnath. Group II. has a roughly triangular set of small paragnaths. Group III. has about three rows of minute

Fig. 4.

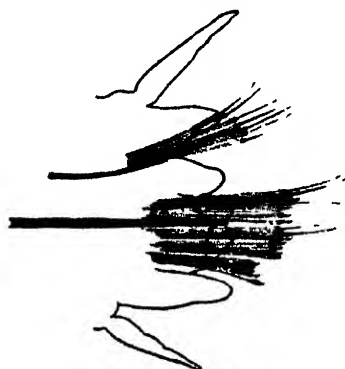
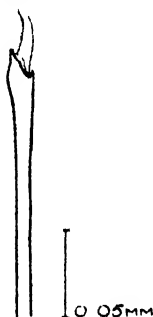


Fig. 5.



0.25MM

0.05MM

Perinereis falsovariegata, sp. n.

Fig. 4.—Anterior foot.

Fig. 5.—Heterogomph falciger.

paragnaths arranged in a pectiniform series. Group IV. is similar to Group III. Group V. has a single paragnath. Group VI. has a single transverse paragnath. Groups VII. and VIII. are continuous and have two or three rows of paragnaths.

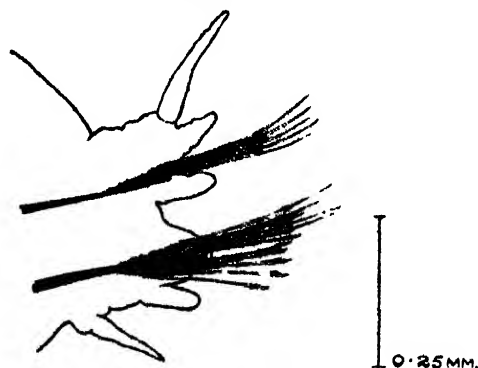
The feet show very little change from before backwards. In an anterior foot (fig. 4) the dorsal cirrus is about twice as long as the upper dorsal ligule. The dorsal ramus has only two ligules—a rather small conical upper ligule and a shorter and blunter lower ligule. In the ventral ramus the chæta-sac is as prominent as the

upper dorsal ligule and has a bilobed anterior lip, a little longer than the posterior lip. There is a rather narrow ventral ligule and a small tapering ventral cirrus.

The notopodium has only homogomph spinigers. In the upper part of the neuropodium there are homogomph spinigers and heterogomph falcigers (fig. 5), and in the lower part heterogomph spinigers and heterogomph falcigers. I see no homogomph falcigers.

There is very little change in the feet (fig. 6) in the hinder region. The ligules are a little narrower and more pointed. There is no relative increase in size of the dorsal ramus. The anus is terminal and directed upwards and carries a pair of long anal cirri.

Fig. 6.



Perinereis falsovariegata, sp. n.

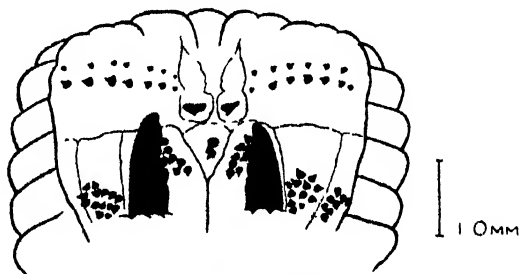
Posterior foot.

Remarks.—I have compared the arrangement of the paragnaths in this specimen with that of the examples of *P. variegata* in the present collection, and they are exactly alike. Moreover, the paragnaths correspond completely to those figured by M'Intosh (1903, pl. i. figs. 6 & 7) for his *P. variegata*. Furthermore, the anterior feet in both species are very similar. In fact, the present species differs from *P. variegata* only in size—it appears to be much smaller—and in the fact that there is no elongation of the upper dorsal ligule in the posterior region.

A similar relation is known to exist between several pairs of species of *Nereis*. Thus *P. cavifrons* Ehlers is distinguished from *P. pseudocavifrons* Fauvel only by the absence of modification of the feet in the hinder region, and an exactly similar relation exists between *N. unifasciata* Willey and *N. coutierei* Gravier, and also between *P. camiguina* Grube and *P. pseudocamiguina* Augener. This curious parallelism of variation in the Nereids seems to illustrate Vavilov's (1922, p. 75) law of homologous series in variation, and the whole question of homologous variation in the Polychætes would repay investigation.

Fauvel treats *variegata* as a *Pseudonereis*, *sensu* Saint-Joseph and Gravier.

Fig. 7.



Perinereis capensis (Kinberg).
Proboscis as dissected from below.

Perinereis capensis (Kinberg).

Arete capensis Kinberg, 1865, p. 174.

Occurrence.—Stil Bay (1).

Description.—A single specimen measuring 43 mm. by 2 mm. without the feet for 53 chaetigers. It is incomplete posteriorly, but from the tapering of the body at the hinder end I infer that no great part has been lost. The colour in spirit is pale yellow, lighter ventrally than above. The prostomium is not emarginate in front, and the tentacles reach to the end of the very massive palpophores, which are surmounted by small conical palps. There are two pairs of eyes disposed in a rectangle. The tentacular cirri are short, the longest reaching back only to the middle of the third chaetiger.

The jaws are dark and massive, and have four teeth beneath the main fang. The proboscis (fig. 7) is retracted so that the paragnaths can be seen only by dissection. Group I. has two rather large paragnaths set one behind the other; II. has an oblique double row of about 12 paragnaths; III. has a rather large triangular group; IV. has a group of about eight paragnaths; V. is absent; VI. has a single large transverse paragnath; VII. and VIII. have a double row, of which the anterior (when the proboscis is everted) has the larger paragnaths.

The feet show very little change from before backwards. An anterior foot (fig. 8) has a very long dorsal cirrus,

Fig. 8.

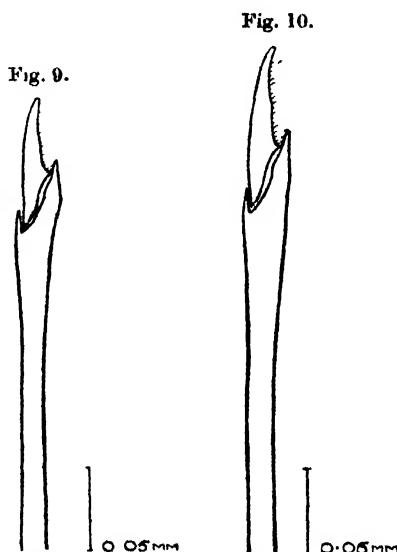
*Perinereis capensis* (Kinberg).

Anterior foot.

about twice as long as the upper dorsal ligule, and set far forward on the foot. The dorsal ramus has three ligules—a triangular upper dorsal ligule, a much smaller intermediate ligule, and a lower dorsal ligule similar to the upper. The intermediate ligule is formed by the prolongation of the anterior lip of the notopodial chæta-sac, and while it is free on its upper side, on its lower side it is fused for almost its whole length with the lower notopodial ligule. The anterior lip of the neuropodial chæta-sac is bilobed, and the posterior rather sharply

pointed. Beneath this is the ventral ligule, which is similar to the dorsal ligules. The tapering ventral cirrus is a little more than half the length of the ventral ligule.

There are only two or three bristles in the notopodium and these are all slender homogomph spinigers. In the upper part of the neuropodium there are homogomph spinigers and short, rather stout, heterogomph falcigers (figs. 9 & 10); in the lower part there are a few hetero-



Perinereis capensis (Kinberg).

Fig. 9.—Heterogomph falciger.

Fig. 10.—Heterogomph falciger.

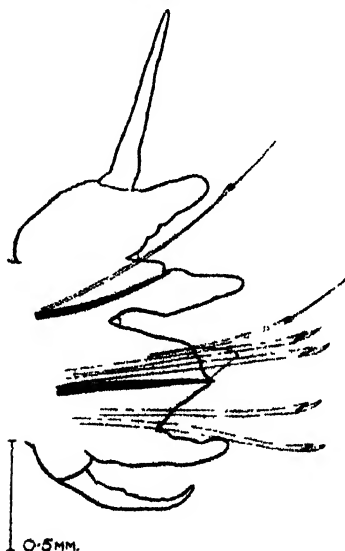
gomph spinigers, and the rest are heterogomph falcigers. I see no homogomph falcigers.

In the posterior region there is very little change in the character of the feet (fig. 11). The ligules are narrower and more pointed and the posterior lip of the ventral chæta-sac more prominent. There is no suggestion of an increase in size of the dorsal ramus.

Remarks.—I have not seen Kinberg's type, and consequently it is only an assumption that this is Kinberg's

species, of which only a brief diagnosis without figures is given. My specimen agrees with his account as far as the latter goes. Kinberg's type was from the Cape, and, moreover, the absence of Group V. of paragnaths is very rare in species of *Perinereis*. The *P. cavifrons* Ehlers, from Malay, appears to be very close indeed to this species. *P. pseudocavifrons* Fauvel, from New Caledonia, is a *P. cavifrons*, in which the upper dorsal ligule increases enormously in size in the hinder region. *P. calmani* mihi, from East Australia, also has an

Fig. 11.

*Perinereis capensis* (Kinberg).

Fiftieth foot.

analogous arrangement of paragnaths, but groups VII. and VIII. are reduced to a single row. The Malayan *P. sulwana* Hirst is also without a group V., but here all the aboral paragnaths except those of group VI. are absent.

To the best of my knowledge *P. capensis* (Kinberg) has not been seen or described since the original record.

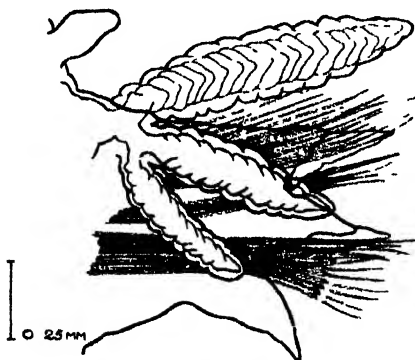
Family Glyceridæ.

Glycera convoluta Keferstein
var. *capensis*, nov.

Occurrence.—Seaforth (1).

Description.—The colour in spirit is pale yellow. The specimen measures 83 mm. by 4 mm. without the feet. The body is rounded and very little tapered posteriorly. The segments are biannulate. The prostomium is conical and equal in length to three and a half segments in the middle of the body. I cannot count the rings. The proboscis is only partly everted, but appears to be long. The papillæ are cylindrical, cut

Fig. 12.



Glycera convoluta var. *capensis*, nov.

Middle foot from behind.

off obliquely at the top and have a kind of chitinous finger-nail exactly as in *G. convoluta*. I have seen no rounded papillæ. The supports of the jaws are prolonged on one side only. The feet, very minute for the first few segments, increase in size up to about the 10th chætiger. The small conical dorsal cirrus is situated a little way above the foot and appears at the third chætiger. The feet (fig. 12) have two rather long and pointed anterior lobes of about equal size and two shorter, triangular posterior lobes also of about equal size. There is a triangular ventral cirrus resembling one of the posterior lobes. The gills are not retractile; they begin on the

24th chaetiger and are continued to about the 20th chaetiger from the end of the body. They appear at the upper and posterior edge of the foot where it joins the body, and lie behind the foot. At first there is a single filament reaching to the end of the upper posterior lobe of the foot. This lengthens out until at about the 30th foot it reaches to the ends of the bristles, and at the same time a second filament appears, and a short distance farther back a third. Thus, in the middle of the body, we have an upper filament reaching to the end of the bristles, below this a second filament reaching about to the end of the upper posterior lobe, and below this again a third filament about half the length of the first. The occurrence of the third filament is sporadic, for in the middle of the body it may be absent from several feet and then appear again. In the posterior region the gills gradually disappear. The third or lowest disappears first, then the second becomes gradually reduced and disappears, and, lastly, the uppermost or first, which can still be seen as a small papilla at about the 20th chaetiger from the end. The bristles are of the usual type—simple dorsal bristles, and two bundles of compound ventral bristles with homogomph articulations and long finely denticulated blades. In the posterior region the feet are rather longer and the pedal lobes more elongate and narrow.

Remarks.—This variety differs from *G. convo'uta* in having the two posterior lobes of the feet equal and in having two or three branchial filaments instead of one.

I had great hesitation in making a new variety of this specimen, but I can find no account of a species belonging to the *alba*, *convoluta* (*tridactyla*), *africana* group, which has trifilamentous gills. Whether the *G. alba* recorded by Ehlers from Angra Peguena and by M'Intosh from the Cape really belong here I do not know. M'Intosh mentions that the gills in his specimens were bifid (M'Intosh, 1924, p. 36), so that I suspect that his specimens, at any rate, belong to the present variety.

Family Euniceidae.

Eunice filamentosa Grubo.

Augener, 1918, p. 324, with synonymy.

Occurrence.—Stil Bay (1).

Remarks.—This species has already been recorded as *E. cirrobranchiata* by M'Intosh (1924, p. 25) from a depth of 20 fms. off the Cape.

Lysidice capensis Grube.

M'Intosh, 1903, p. 40, pl. iii. fig. 13.

Occurrence.—Stil Bay (4).

Remarks.—This species has reniform eyes and very short tentacles. It is probably the same as *L. collaris*, but I see no collar. The tips of the palps and tentacles are white. Otherwise, for about the first 20 chaetigers, the dorsal surface is a deep brown punctuated with small white dots.

Family Lumbrinerellæ.

Arabella mutans (Chamberlin).

Ctenothrix mutans Chamberlin, 1919, p. 330, pl. lxi. figs. 1-9, pl. xlii. fig. 1.

Arabella novecrinita Crossland, 1924, p. 71, figs. 80-95.

Arabella novecrinita var. *logani* Crossland, 1924, p. 75, figs. 96-98.

Arabella novecrinita var. *atlantica* Crossland, 1924, p. 78, figs. 99-102.

Arabella novecrinita var. *asymmetrica* Crossland, 1924, p. 80, figs. 103-105.

Occurrence.—Stil Bay (2).

Remarks.—I am inclined to take a wider view of the variation in the jaw-plates of this species than does Crossland. It is distinguished from *A. iricolor* chiefly by the presence of hooded acicular bristles. I have examined the jaw-plates of one of the specimens, and it is near to Crossland's figure 105 of his var. *atlantica*. The pincers are not so asymmetrical as those in the figure, the toothed portion of the left pincer being only slightly longer than that of the right. Moreover, the teeth of both pincers are of about equal size. M'Intosh records an *Arabella* from the Cape under the name of *A. iricolor* Montagu var. *cærulea* Schmarda.

Family Cirratulidæ.

Audouinia filigera (Delle Chiaje)
var. *capensis* (Schmarda).

Monro, 1830, p. 154, with synonymy.

Occurrence.—Stil Bay (10); Preekstoel (1).

Audouinia filigera (Delle Chiaje)
var. *meridionalis* (Marenzeller).

Cirratulus tentaculatus var. *meridionalis* Marenzeller; Augener, 1918, p. 461, pl. vi. figs. 175-176.

Occurrence.—Stil Bay (3).

Family Chlorhæmidæ.

Flabelligera affinis Sars.

Fauvel, 1927, p. 113, fig. 40, a-f.

Occurrence.—Seaforth (1).

Remarks.—This species has been recorded several times from the Cape as *F. luctator* Stimpson.

Stylarioides capensis (M'Intosh).

Trophonia capensis M'Intosh, 1885, p. 363, pl. xlv. figs. 7-8, pl. xxiii. A, figs. 1-3.

Stylarioides kinseboanus Augener, 1918, p. 440, pl. vi. fig. 50, pl. vii. fig. 214, text-fig. lxiv.

Occurrence.—Seaforth (1).

Family Capitellidæ.

? *Leiochrides africanus* Augener.

Augener, 1918, p. 472, pl. vii. figs. 199-200, text-fig. lxxiv.

Occurrence.—St. James (1).

Remarks.—I can only very doubtfully attribute this specimen to Augener's species. It is a large worm, superficially extremely like a *Lumbricus*, and measures 120 mm. by 7 mm. across the body in the middle of the thorax. Augener describes the head as biannulate and cone-shaped. In my specimen the prostomium is shaped like a horse-shoe, and there is no trace of any constriction. There are no eyes. The prostomium is followed by an achæitous buccal segment. This is followed by a second achæitous segment. The third segment has neuropodial bristles only; the fourth has both notopodial and neuropodial bristles, which are continued for the following ten segments to the end of the thorax. Thus the thorax is composed of 14 segments, of which 12 are chætigera, the first two being achæitous and the third having ventral bristles only. The thoracic segments are biannulate, but for the first four segments the dividing groove is limited to the back and sides. The

fifth segment is divided completely. The thorax has only capillary bristles and the abdomen only hooks.

The thoracic bristles are simple bilimbate capillaries, apparently rather different from those described by Augener, which seem to have been bordered on one side only. The abdominal hooks are very like those figured by Augener. I can see in profile only a single tooth above the main fang.

In the hinder region pits containing retractile branchiæ are visible just above the ventral tori, and in two or three segments the branchiæ are extruded. They are ramified structures with three or four globular filaments. There is a simple terminal anus without appendages.

This specimen clearly belongs to the *Dasybranchus* group of Capitellids and agrees in a general way with Augener's species from tropical West Africa, but whether it can be regarded as conspecific with the specimens described by Augener is doubtful.

Family Maldanidæ.

Nicomache lumbriculis (Fabricius)

var. *capensis* M'Intosh.

Nicomache capensis M'Intosh, 1885, p. 399, pl. xlv. fig. 4, pl. xxiv. A, figs. 18-19, pl. xxxvii. A, fig. 2.

Nicomache lumbriculis (Fabricius) var. *capensis* M'Intosh, 1904, p. 71.

Occurrence.—Seaforth (1).

Remarks.—M'Intosh gives the number of chætigers for his specimens as 20. In the present example there are 22 chætigers and two preanal achætous segments as in the European form.

Clymene (*Euclymene*) *lumbricoides* Quatrefages.

Fauvel, 1927, p. 172, fig. 59, a-i.

Occurrence.—Stil Bay (1).

Remarks.—I believe this to be the first record of this species from the Cape.

Clymene (*Praxillella*) *prætermissa* (Malmgren)

var. *capensis* M'Intosh.

Praxilla prætermissa Malmgren var. *capensis* M'Intosh, 1904, p. 73.

Occurrence.—Stil Bay (1).

Remarks.—The variety agrees with the stem-form in having 19 chætigers, but differs from it in having the more slender type of dorsal bristles pinnate instead

of smooth, and in having only two short achæitous preanal segments instead of four rather long ones.

Family Terebellidæ.

Nicolea macrobranchia (Schmarda).

Augener, 1918, p. 527, pl. vii. figs. 232-233, text-fig. lxxxix.

Occurrence.—Stil Bay (12).

Thelepus plagiotoma (Schmarda).

Augener, 1914, p. 95, with synonymy.

Fauvel, 1919, p. 455, text-fig. x.

Occurrence.—Stil Bay (5); Preekstoel (1).

Remarks.—I agree with Augener and Fauvel that this species is distinct from *T. setosus* (Quatrefages). M'Intosh has recorded *T. cincinnatus* from the Cape, and the specimens described by M'Intosh as *Thelepus* sp., also from the Cape, are probably examples of *T. pequeni-anus* Augener. This last species is very near to, if not identical with, *T. triserialis* (Grube).

Family Sabellidæ.

Dasychone violacea (Schmarda).

Johansson, 1927, p. 164, with synonymy.

Occurrence.—Seaforth (3).

Remarks.—I am inclined to think that *D. violacea* and the *D. natalensis* (Kinberg) of Johansson are the same species, and the extent of the spiral winding of the gill-bases is a question of age. In the present specimens the gill-bases take a single spiral turn. If my opinion is correct, the examples attributed by me (1930, p. 202) to *D. natalensis* should have gone to *D. violacea*, and the specimen I named (*ibid.* p. 201) *D. violacea* is a young example of this species.

Sabellastarte longa (Kinberg).

Sabella longa Kinberg, 1867, p. 352.

Bispira volutacornis M'Intosh, 1904, p. 83, pl. viii. figs. 43-50.

Non *Bispira volutacornis* (Montagu).

Sabella longa Johansson, 1925, p. 10, figs. 3, 5-7.

Occurrence.—Preekstoel (2).

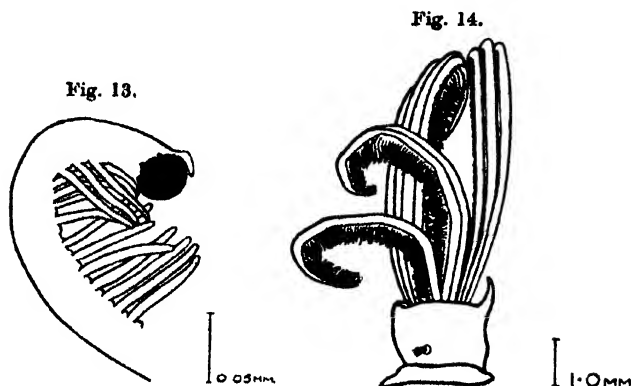
Remarks.—Pick-axe bristles are absent.

Branchiomma quadrioculatum Willey.

Willey, 1905, p. 307, pl. vii. figs. 168-169.

Occurrence.—Stil Bay (1).

Description.—This specimen measures 18 mm. by 2 mm. for the body and 5 mm. for the gills. There are about 60 chætigers, of which eight are thoracic. The body is slender and flattened. Except for several reddish-brown bands on the inner surface of the branchiæ, there is no colour. The two branchial lobes are equal, not spiral, and have 13 filaments each. The palmar membrane is extremely low. The dorsalmost filament of



Branchiomma quadrioculatum Willey.

Fig. 13. — Dorsalmost filament with compound eye.

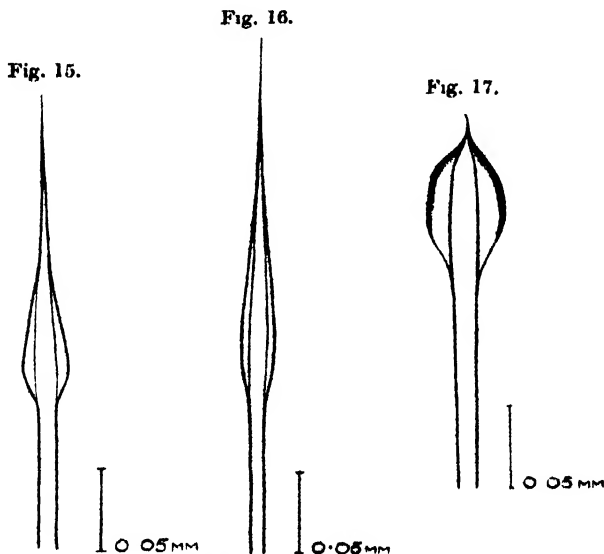
Fig. 14. — Anterior region from side.

each lobe (fig. 13) carries a large, black, compound eye just below the tip in a position exactly corresponding to that of the eyes of *Branchiomma vesiculosum*. The filament adjacent to the dorsalmost on the left side and the two filaments lying next to the dorsalmost on the right side carry very much smaller eyes in similar positions. The remaining filaments are without eyes. There is a pair of triangular palps and, I think, only a single pair of labial processes. The two halves of the collar are unbroken laterally (fig. 14). They meet in the mid-dorsal line, where they are divided by a notch, and in the mid-ventral line they form a pair of triangular lappets. Otherwise they form a continuous membrane running right round the body. The dorsal submedian notches on each side I do not see. In the positions indicated by Willey there is a pair of pleats or folds

in the collar, but the edge of the collar in front of them is entire and without a notch.

The bristles are typical of *Potamilla*.

The first chætiger bears limbate capillary bristles (fig. 15). The dorsal bristles of the thorax are limbate capillaries (fig. 16) and spatulate bristles with fine points (fig. 17). There is no question here of a transition between the limbate capillaries and the other dorsal



Branchiomma quadriaculatum Willey.

Fig. 15.—Dorsal bristle from first chætiger.

Fig. 16.—Capillary bristle from thorax.

Fig. 17.—Spatulate bristle from thorax.

bristles as in young examples of *Branchiomma*. Here there are about half a dozen limbate capillaries quite distinct from the spatulate bristles. The thoracic tori carry avicular hooks (fig. 18) with long bases and minutely denticulated heads and pick-axe chætæ (fig. 19). In the abdomen the tori carry avicular hooks with rather shorter bases and the ventral bristles are limbate capillaries (fig. 20).

There is a broken piece of tube incrustated with sand-grains. It has a horny substratum.

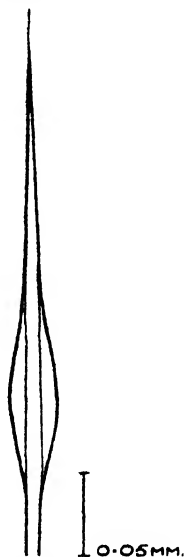
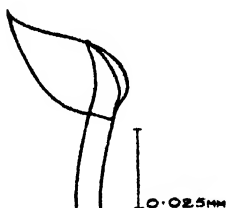
Remarks.—As far as the bristles go, this species appears to be a typical *Potamilla*, and it is only an assumption that the place of the spatulate thoracic bristles will be taken at a later stage by limbate bristles. It is close to *B. bioculatum* Ehlers of the West Indies and the West Coast of Africa, but Augener describes the collar of that species as deeply divided laterally. For that matter, the collar in the present specimen, as has already

Fig. 20.

Fig. 18.



Fig. 19.



Branchiomma quadrioculatum Willey.

Fig. 18.—Thoracic hook.

Fig. 19.—Pick-axe bristle from thorax.

Fig. 20.—Abdominal capillary bristle.

been said, does not altogether agree with Willey's account. The collars in the Sabellids are very delicate and easily torn, and apart from their natural variability they are very apt to be damaged or distorted in examination.

Family Serpulidae.

Serpula vermicularis Linnæus.

Fauvel, 1927, p. 351, fig. 120, a-y.

Occurrence.—Stil Bay (H).

Pomatoleios crosslandi Pixell.

Pixell, 1913, p. 85, pl. ix. fig. 10.

Occurrence.—Stil Bay (25).

Remarks.—With Pixell I cannot find any trace of collar-bristles. The opercular plate is, as Pixell assumed, white and calcareous. It must have been dissolved out in her specimens.

Hydroides spinosus (Pixell).

Eupomatus spinosus Pixell, 1913, p. 78, pl. viii. fig. 5.

Occurrence.—Stil Bay (1).

Remarks.—This Serpulid is conspecific with Pixell's specimens from Suez. I have examined the cotype of Pixell's species, and it has an operculum similar to that of this specimen. Pixell describes the collar as entire. It is entire ventrally, but deeply incised at the sides, and the lateral lobes thus formed are continuous with the thoracic membrane.

A large number of species of *Hydroides* have been described, which are distinguished by details of the ornamentation of the opercular spines. Until we know to what extent the operculum in *Hydroides* is variable they are better left to stand, but in my opinion most of them are nothing but varieties of a polymorphic species, perhaps of *H. uncinata* (Philippi). The *Hydroides norvegica* var. of M'Intosh (1924, p. 50) from the Cape is probably the same species.

Family Sabellaridae.

Gunnarea capensis (Schmarda).

Monro, 1930, p. 176.

Sabellaria capensis M'Intosh, 1885, p. 418, pl. xxv. A, figs. 24–25, pl. xxvi. A, figs. 11–12, and 1904, p. 74.

Augener, 1918, p. 493.

Occurrence.—Stil Bay (3); Preekstoel (7); Seaforth (8); St. James (8).

REFERENCES.

- AUGENER, H. 1913. "Polychæta.—I. Errantia." Michaelsen, W., and Hartmeyer, R.: 'Die Fauna Südwest-Australiens,' iv. pp. 65–304, pls. ii. & iii., 42 text-figs.
 —. 1914. "Polychæta.—II. Sedentaria." Michaelsen, W., and Hartmeyer, R.: 'Die Fauna Südwest-Australiens,' v. pp. 1–170, pl. i., 19 text-figs.
 —. 1918. "Polychæta." Beiträge zur Kenntnis des Meeresfaunas West-Afrikas, Herausgeg. v. W. Michaelsen, ii. (2), pp. 67–625, pls. ii.–vii. Hamburg.

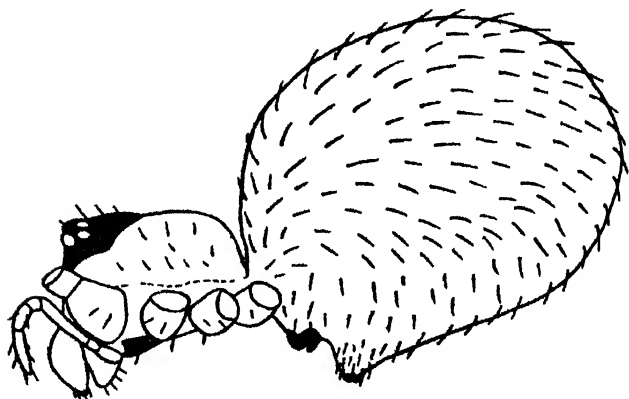
- CHAMBERLIN, R. 1919. "Albatross' Polychæta." Mem. Mus. Comp. Zool. Harvard, xlviii., 514 pp., 80 pls.
- CROSSLAND, C. 1924. "Polychæta of Tropical East Africa, etc." Proc. Zool. Soc. London, (1) pp. 1-106, 126 text-figs.
- EHLERS, E. 1913. "Die Polychæten-Sammlungen d. D. Sudpolarexped., 1901-1903." D. Sudpolarexped. xiii. (4), pp. 397-598, 21 pls.
- FAUVEL, P. 1919. "Annélides Polychètes de Madagascar, de Djibouti et du Golfe Persique." Arch. Zool. exp. gén. lvi. pp. 315-473, pls. xv.-xvii., 12 text-figs.
- . 1923. "Polychètes errantes." Faune de France, v. pp. 488, 181 figs.
- . 1927. "Polychètes sédentaires." Faune de France, xvi. pp. 494, 152 figs.
- GILCHRIST, J. D. F. 1923. "The South African Seas." South African Journal of Science, xx. (1), pp. 1-27.
- GRAVIER, C. 1901. "Contribution à l'étude des Annélides Polychètes de la Mer Rouge." Nouv. Arch. Mus. Hist. Nat. Paris, (4) iii. pp. 147-268, pls. vii.-x., text-figs. 160-285.
- JOHANSSON, K. E. 1927. "Beiträge zur Kenntnis der Polychæten-Familien Hermellidae, Sabellidae und Serpulidae." Zool. Bidrag, Uppsala, xi. pp. 1-184, 5 pls., 15 text-figs.
- KINBERG, J. G. H. 1865. "Annulata nova. Oefvers." K. Vet.-Akad. Forh. Stockholm, arg. 22 (2), pp. 167-179.
- M'INTOSH, W. C. 1885. "Report on the Annelida Polychæta collected by H.M.S. 'Challenger' during the Years 1873-1876." 'Challenger' Rep., Zool. xii., 554 pp., 94 pls.
- . 1903. "Marine Annelids of South Africa.—I." Marine Investigations in South Africa, iii. pp. 19-56, 4 pls.
- . 1904. "Marine Annelids of South Africa.—II." Marine Investigations in South Africa, iii. pp. 59-92, pls. v.-ix.
- . 1924. "Notes from the Gatty Marine Laboratory, St. Andrews.—XLVI." Ann. & Mag. Nat. Hist. London, (9) xiv. pp. 1-52.
- MONRO, C. C. A. 1930. "Polychæte Worms." 'Discovery' Reps. ii. pp. 222, 91 text-figs.
- PIXELL, H. L. M. 1913. "Polychæta of the Indian Ocean, etc." Trans. Linn. Soc. London, ser. 2, Zool. xvi. (1), pp. 69-92, pls. viii.-ix.
- VAILOV, N. I. 1922. "The Law of Homologous Series in Variation." Journ. of Genetics, 12 (1), pp. 47-89, pls. ix. & x.
- WILLEY, A. 1904. "Littoral Polychæta from the Cape of Good Hope." Trans. Linn. Soc. London, ser. 2, Zool. ix. pp. 255-268, pls. xiii. & xiv.
- . 1905. "Report on the Polychæta." Ceylon Pearl Oyster Fisheries, Suppl. Rep. xxx. London, pp. 243-324, pls. i.-viii.

LIV.—Notes on the Biology of Spiders.—X. *British Cellar Spiders, with the Description of a Species new to Britain.*
By W. S. BRISTOWE, M.A., F.Z.S.

FINDING myself staying in an old building, "The Angel Hotel," at Bury St. Edmunds, with ancient cellars built in the fifteenth century, I decided to see these and to collect any spiders which might be living there. Accordingly in the evening of May 16th, 1932, I provided myself with an electric torch and descended.

The cellars proved to be extensive and provided with no exit other than the door through which I had come. A small part only was used for wine and the remainder was bare except for a few loose bricks, boards, and empty cases. In no part could they be described as damp, but in turning over some old boards lying in the driest portion I came across some tiny Pholcids which I at once recognized as being new to Britain. In this one small portion of the cellars both sexes were abundant under every piece of wood I turned over, but elsewhere in the slightly damper portions I could find none. At the time I took them to be some species of *Spermophora*, but microscopic examination showed that they possessed

Fig. 1.

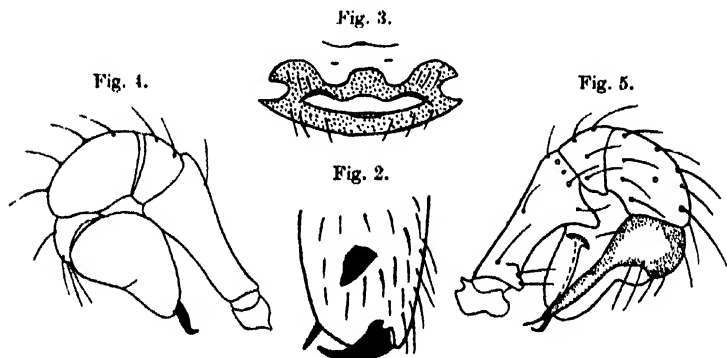


eight eyes, instead of six as in *Spermophora*, which suggested that they belonged to the genus *Physocylus*, one species of which had been recorded from France. Specimens were sent to Monsieur L. Berland in Paris, and he confirmed that they were identical with the French species, *Physocylus simoni* Berl., which he himself had described in 1911.

During the last few months I have collected spiders in cellars at Petworth and Balcombe (Sussex), Witley (Surrey), Swanage and Studland (Dorset), and Oxford in the hope of rediscovering *Physocylus* elsewhere, and I met with success in the last-named town on July 23rd. The "Mitre Hotel" cellars are several hundred years

old. In one part damp is oozing from the walls, and it was here that spiders were most abundant, but, as at Bury St. Edmunds, *Physocyclus* lived and constructed a small flimsy sheet web between and under wooden cases in the dry portions only. Both sexes were numerous, and one female had a round egg-cocoon in her chelicerae.

Our only other Pholcid, *Pholcus phalangioides* Fuess., measures 8 to 9 mm., and it is a giant beside the 2.5 to 3 mm. *Physocyclus*. Furthermore, the abdomen of *Physocyclus simoni* Berl. is globular and as high as it is long (fig. 1). This is thinly clothed with fine hairs, and has a faint bluish tinge which becomes intensified in alcohol. The sternum is wider than long, and distinct lines divide the cephalic



from the thoracic region. The chelicerae are provided with a strong tooth in both sexes, and in the male a stout tooth is present one-third of the way from the distal border of the basal segment (fig. 2). The spinnerets are short and situated on a prominence close to the genital openings. In the adult female the vulva has the appearance of a slit with a broad dark irregular border (fig. 3). The palps are short, and in the male the tarsus has a long narrow branch which lies along and extends to the end of the bulb. This is terminated by a thin black spinous process not portrayed in Berland's accurate drawing* on account of this showing the natural position of the palpal organ pressed back against the femur. The bulb is pear-shaped and terminated by a strong black curved hook (figs. 4 & 5). The legs are very long, thin, and pale.

* Arch. de Zool. Exper. et Gen. 1911, p. cxiii.

So far as is now known, this species is restricted to Great Britain and France. In the latter country it has been found in Paris (*L. Berland and de Dalmas*), Versailles (*L. Berland*), Saint-Germain-au-Mont-d'Or, Rhône (*de Dalmas*), Asnières (*P. Lesne*), and Toulouse (*P. Bonnet*). In each case it was found in cellars under or amongst planks and pieces of wood. Other members of the genus are house-spiders in tropical countries, but, whether or not it is ultimately discovered elsewhere, the occurrence of thriving colonies in France and Great Britain justifies its inclusion in the fauna lists of those countries*.

A brief *résumé* of the results of my collecting follows:—

1. *Angel Hotel, Bury St. Edmunds, Suffolk.* May 16th, 1932:

Tegenaria atrica C. L. K.
— *derhamii* Scop.
Amaurobius ferox Walck.
Steatoda bipunctata Linn.

Physocyclus simoni Berl.
Leptyphantès leprosus Ohl.
— *pallidus* Camb.

2. *Burton Park, Petworth, Sussex.* June 18th, 1932.
Cellars under 30 years old. Extensive:

Tegenaria derhamii Scop.
Oicurina cinerea Panz.
Amaurobius ferox Walck.

Pholcus phalangioides Fuess.
Nesticus cellulanus Clerok.
Leptyphantès leprosus Ohl.

3. *Grand Hotel, Swanage, Dorset.* July 14th, 1932.
Cellars, very small and under 40 years old. Dry:

Tegenaria derhamii Scop.
Amaurobius ferox Walck.

Pholcus phalangioides Fuess.
Leptyphantès leprosus Ohl.

4. *Manor House, Studland, Dorset.* July 15th, 1932.
Cellars under 30 years old. Damp:

Tegenaria derhamii Scop.
Amaurobius ferox Walck.
Pholcus phalangioides Fuess.

Leptyphantès leprosus Ohl.
— *pallidus* Camb.

5. *Mitre Hotel, Oxford.* July 23rd, 1932. Several hundred years old. Part damp, part dry:

Tegenaria derhamii Scop.
Amaurobius ferox Walck.
Physocyclus simoni Berl.

Nesticus cellulanus Clerok.
Leptyphantès leprosus Ohl.
Ohthonius rayii L. K.

6. *Witley, Surrey.* August 8th, 1932. Cellars old, but not extensive. Damp:

Tegenaria derhamii Scop.
Amaurobius ferox Walck.
Leptyphantès leprosus Ohl.

Erigone dentipalpis Wid.
Lessertia denticulata Sim. (with round white egg-oocons).

* Vide *L. Berland*, *Ann. Soc. Ent. Fr.*, June 30, 1931, p. 21.

7. Balcombe, Sussex. November 12th, 1932. Cellar new, clean and dry :

Tegenaria derhamii Scop.
Pholcus phalangioides Fuess.
Steatoda bipunctata Linn.

Nesticus cellulanus Clerck.
Leptyphantes leprosus Ohl.
— *pallidus* Camb.

Examinations of these lists show that the spider inhabitants can be divided into three classes :—

(A) Accidentals, *Erigone dentipalpis* Wid. and *Steatoda bipunctata* Wid., neither of which are true cellar spiders.

(B) Species which are not restricted to cellars (though they commonly inhabit them) and which live in houses and/or somewhat shady positions outside : the *Tegenariæ*, *Amaurobius*, *Pholcus*, *Leptyphantes leprosus* Ohl., *L. pallidus* Camb.

(C) Species peculiar to (or at least typical of) cellars : *Cicurina cinerea* Panz., *Physocyclus simoni* Berl., *Nesticus cellulanus* Clerck, *Lessertia denticelis* Sim.

These collections by no means exhaust the list of spiders known to inhabit cellars in Great Britain. There is, for instance, the large *Meta menardi* Latr., which has a wide distribution in cellars, *Tapinocyba subitanea* Camb., *Porrhomma egeria* Sim., *P. thorelli* Herm., and *P. microphthalmum* Camb.

Light-loving spiders are not to be found breeding in cellars, and even amongst the regular inhabitants different degrees of darkness-tolerance can be detected. Thus *Amaurobius ferox* and *Tegenaria atrica* are concentrated chiefly near the entrance, whilst *T. derhamii* and *Pholcus phalangioides* is not so abundant in the darker corners of extensive cellars as the cellar-specialist Linyphiids or *Meta menardi*.

It may be asked how these spiders eke out a livelihood in these self-imposed dungeons. The answer is that in some cellars, particularly the damper ones, there is quite a large and numerous fauna consisting from my own observation in the above cellars of beetles (*Blaps*, Carabids, Staphylinids), flies (Musoids, Drosophilids, and Nemato-cera), small moths, woodlice, centipedes, Collembola, and Pseudoscorpions. Twice I found *Pholcus phalangioides* eating a moth and once a Musoid ; in *Amaurobius ferox* snares I found beetle, woodlouse, and fly remains ; *Nesticus cellulanus* was seen eating a moth and a nematoceros fly ; a *Tegenaria atrica* was busy devouring

a male *Amaurobius ferox*. In captivity *Physocyclus* ate a *Chthonius*, small cellar flies, and moths, whilst *Physocyclus*, in its turn, was killed by *Linyphia leprosus*.

The identification of very young spiders is impossible in the majority of species, but it is undoubtedly the case that cellar spiders migrate from one cellar to another when they are very young. I have detected very young specimens of *Meta menardi* in the open, and the assumption is not remarkable when we recall that a cellar existence is secondary and that all the species spring from open-air ancestors. A parallel is provided by *Epeira umbratica*, which is light-shy in the adult stage and sun-loving when young. The difficulty of understanding how cellar spiders have succeeded in obtaining such a wide range is simplified when we realize (1) that caves, sewers, and even hollow trees and mole or rabbit burrows provide equally suitable habitats for some of them, and (2) that some, including *Physocyclus* and *Pholus*, must be carried from cellar to cellar by man.

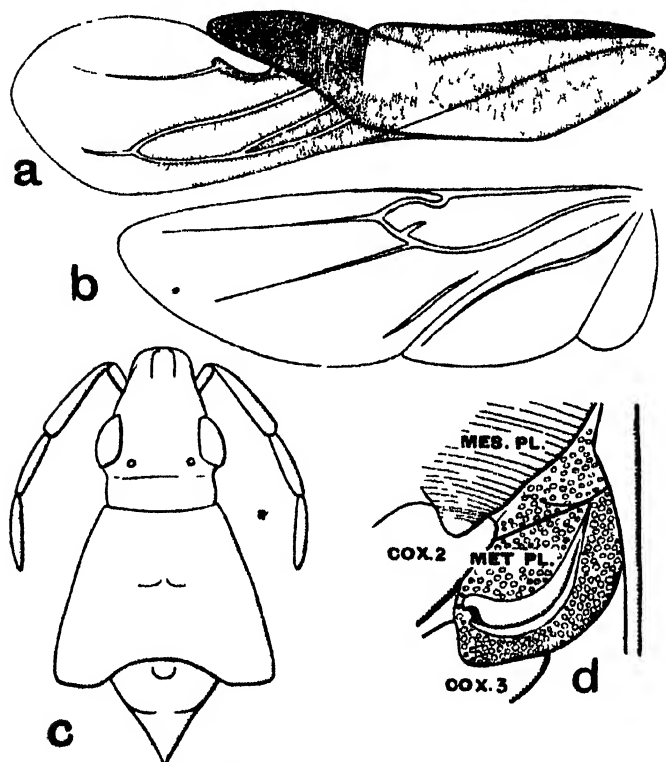
LV.—*A new Genus and Species of Anthocoridae (Hemiptera) from New Zealand.* By W. E. CHINA, M.A.

THE following description is based on material received for identification through the Imperial Institute of Entomology.

MAORICORIS, gen. nov.

Narrow, elongate. Head exserted, eyes distant from anterior margin of pronotum; about one-fourth longer than wide across eyes (35:28); antennae relatively short, shorter than head and pronotum together; first segment not reaching apex of head, last two segments fusiform not linear, scarcely more pilose than first two segments; rostrum sparsely covered with short hairs, extending just beyond anterior coxae; first (apparent) segment shorter than second, third very short (23:30:7). Pronotum narrow, but shorter than broad across humeral angles (38:48), anterior collar completely absent, lateral margins straight, posterior margin very thin, deeply emarginate exposing mesonotum (base of scutellum), about twice as wide as anterior margin (48:25); anterior disc convex, calli obsolete, posterior disc slightly flattened. Scutellum convex. Hemelytra narrow, not punctate,

cuneus large, rounded at apex, cuneal fracture distinct ; membrane with four longitudinal veins, the middle two running into the interior vein to form two basal cells. Basal cell of wing with a hamus arising from the "vena connectente." Mesosternum apically not constricted or produced between middle coxæ, mesopleura



Maoricoris benefactor, gen. et sp. n.

- a. Hemielytron showing colour-pattern and venation of membranes. b. Hind wing showing position of hamus. c. Head, pronotum, and scutellum from above. d. Meso- and metapleura showing structure of opening of scent-gland.

striate. Metasternum very small, subtriangular, and tuberculiform, not medianly carinate, metapleural orifice distinct, the rim broad, swollen and produced outwards and forwards, as shown in figure (d), in a gradual curve

to anterior margin of pleura; lateral margin of pleura not elevated or carinate. Anterior femora more or less incrassate, unarmed with spines; middle and hind femora much less so, hind coxæ subcontiguous. Abdomen towards apex with a few long bristle-like hairs laterally. Ovipositor absent or obsolete.

Genotype, *Maoricoris benefactor*, sp. n.

By the presence of a hamus in the hind wing cell arising from the "vena connectente," this genus is related to the *Lycetocorinae*. It differs, however, in the non-linear third and fourth antennal segments. Judging by Reuter's keys (Act. Soc. Sci. Fennicæ, xiv. p. 559, 1885), it comes nearest to *Piezostethus*, but is readily distinguished by the thick third and fourth antennal segments, elongate form, venation of membrane, etc. It differs from the Australian *Oplobates* Reut. in the much longer rostrum and in the unarmed anterior femora, while the pilosity and shorter rostrum distinguish it from the Australian *Lasiellidea* Reut. If the position of the hamus is ignored and *Maoricoris* is referred to the *Anthocorinae* on the strength of the antennal structure, then the new genus differs from all the genera with unarmed anterior femora by the structure of the pronotum with the anterior collar obsolete. It differs from *Triphleps* in the elongate form and in the venation of the membrane and, of course, in the position of the hind wing cell hamus. The affinities of this genus are thus very obscure.

Maoricoris benefactor, sp. n.

Colour.—Head shining deep ferruginous-brown; eyes reddish, ocelli red; rostrum yellow, extreme base infuscate; antennæ black. Pronotum shining dark ferruginous-brown becoming paler posteriorly, especially towards the humeral angles and along posterior third of lateral margin; prosternum and pleura shining ferruginous-brown, becoming paler towards humeral angle, acetabula sordid white. Scutellum shining ferruginous-brown, extreme apex black; meso- and metasterna and pleura shining ferruginous-brown, the rim of the metapleural orifice paler. Hemelytra rather dull fuscous-brown, an elongate spot down claval commissure one-half on the apex of each clavus and an indefinitely round spot at apex of embolium extending on to corium but not on to cuneus, on each hemelytron,

sordid pale yellow; membrane infusate, paler toward apical margin. Coxæ sordid yellow, testaceous towards base; trochanters pallid; femora ferruginous-brown, base and apex of each sordid yellow; tibiæ and tarsi pallid yellow. Abdomen shining deep ferruginous-brown, darker towards apex.

Pilosity and Structure.—Head with vertex and clypeus sparsely covered with short pale hairs, six symmetrical long pale bristles, three on each side of head, one arising between ocellus and eye, another at anterior margin of eye, and the third (somewhat shorter) from middle of gena at edge of clypeus; posterior margin of vertex behind the ocelli with a characteristic fringe of backwardly directed, moderately short, pale bristles; antennæ more or less densely pubescent. Relative length of antennal segments, 9:21:16:16. Scutellum moderately densely pilose on apical half, basal half subglabrous. Mesopleura transversely striate, metapleura granulate. Hemelytra, including cuneus, sparsely but regularly pilose, the hairs pale and sub-depressed. Legs moderately pilose, the tibiæ with longitudinal rows of suberect bristle-like hairs. Abdomen irregularly pilose, more densely so towards apex where the hairs become longer; two very long hairs one on each side of genital segments.

Total length 2.8 mm.; width across humeral angles 0.7 mm.

Habitat.—New Zealand; Nelson, 1 ♂ (type) and 2 ♀♀ preying on the New Zealand bark-beetle, *Acrantus opacus* White, living on *Pittosporum* sp., November 1931 (*A. F. Clark*).

This species is apparently endemic to New Zealand and unrelated to the Anthocoridæ of any other region. Its association with the endemic beetle *Acrantus opacus* supports this idea.

Probably all the Anthocoridæ are predaceous on the eggs and larvæ of other insects, and even on the adults of smaller forms, such as Aphididæ and Coccidæ. In many cases, however, they also supplement their diet with the sap of plants. Many species are cortical or subcortical in habit and there is nothing surprising in the feeding-habits of *Maoricoris*. *Lycocoris campestris*, which is commonly found in stables and cattle-sheds, is recorded by Reuter as sucking the blood of

horses and cattle and may possibly transmit the dreaded foot and mouth disease. *Triphleps insidiosus* Say and *T. australis* China feed on the eggs of the false cotton-boll worm, *Heliothis obsoleta*; the many species of *Anthocoris* found in flowers probably prey on the thrips which live there, while *Piezostellus flamipes* Reuter, which occurs in grain-ships and granaries, probably feeds on the eggs and larvæ of grain-feeding Coleoptera and Lepidoptera, or perhaps on mites (Acarina).

Textbook of Palæontology. By KARL A. VON ZITTEL. Translated and edited by CHARLES R. EASTMAN, Ph.D. Vol. II. Second English edition, revised, with additions, by Sir ARTHUR SMITH WOODWARD, F.R.S. 8vo. 464 pp., 533 figures in the text. Macmillan. Price 30s. net.

THIS volume of the second English edition of Zittel's famous textbook contains all the Vertebrates except the Mammalia. The thirty years that have passed since the publication of the first English edition have witnessed great advances in palæontology, and the many new discoveries have necessitated not merely a revision and enlargement, but to a large extent a rearrangement and a new classification. In the preface the author admits that there is sometimes a little conservatism, but this applies mainly to the Tertiary fossils, which in the groups included in this volume appear to belong for the most part to recent families, but need further study before they can be assigned their places in a modern system.

Disagreement with certain parts of the classification is, of course, possible. Many will consider the Ganoidei a somewhat heterogeneous assemblage. Also it may be open to question whether the Cochliodont sharks are nearer to the Petalodontidæ than to the Hybodontidæ. The Leptolepidæ, with a truly homocercal caudal fin, appear to be wrongly placed in the Halecostomi.

The general plan of the book is that for each class there is an introductory section on the skeleton and a final one on range and distribution; between these is a systematic account, with diagnoses of orders, families, etc., and under each family an annotated list of the principal genera, with footnotes giving references to further information. The illustrations are numerous and good, and add greatly to the value of the book.

This volume is indispensable to the student, and it brings together in a convenient form a summary of present knowledge of fossil reptiles, amphibians, and fishes that should interest every zoologist.

C. T. R.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 65. MAY 1933.

LVI.—*Some Upper Carboniferous Brachiopods from Brazil.*
By F. R. COWPER REED, Sc.D., F.G.S., Sedgwick
Museum, Cambridge.

[Plate IX.]

A SMALL representative collection of Carboniferous brachiopods from the Urupady River, State of Pará, Brazil, was recently sent me by Dr. Euzebio de Oliveira, Director of the Geological Survey of Brazil, for presentation to the Sedgwick Museum. Most of the species in this fauna were described nearly sixty years ago by Derby (1), who twenty years later (2) revised them in a paper on the Amazonian Upper Carboniferous fauna. Katzer (3), in 1903, gave a general description of the geology of this region, and figured most of the old and a few new species from the same formation. King (4) has recently pointed out that this Amazonian fauna has many peculiarities, but is probably of Lower Pennsylvanian age, and resembles one found in Arizona. There are, however, a few forms of special interest and at least two undescribed species in the present collection, which bring the North and South American Pennsylvanian brachiopod faunas into closer relation; and the

Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 36

specimens accordingly deserve the following brief notes. The fossils are mostly in a good state of preservation, being silicified, and often show a concentric growth of the silica on their surface.

LIST OF SPECIES.

- Productus* (*Dictyoclostus*) *chandlessi* Derby.
 — (*Margifera* ?) *semistriatus* Moek var. nov. *bramliensis*.
 — (*Lanoproductus*) *cora* D'Orb.
 — (*Juresania*) *paraensis*, sp. n.
 — (*Echinoconchus*) *nevadensis* Moek.
 — (*Avonia*) *derbyi*, sp. n.
Orthis (*Rhipidomella*) *penniana* Derby.
 — (*Schizophoria*) *resupinata* Mart., cf. var. *latirotrata* Toulou.
Derbya buchi (D'Orb.).
Spirifer condor D'Orb., vars. 1 and 2.
 — (*Neospirifer*) *triplicatus* Hall.
 — (—), cf. *costella* King.
 — (*Brachythyris*) *opimus* Hall.
 — (—) *rockymontanus* Marcou (pars).
 — sp.
Squamularia perplexa (McChean.).
Cleiothyridina orbicularis (McChean.).
Composita subtilata (Hall).
 — *trilobata* Dumbar & Condra.
 — *mexicana* (Hall).

Productus (*Dictyoclostus*) *chandlessi* Derby.

This species, which Derby (1, p. 51, pl. iv. figs. 1-4, 9-11 (non figs. 13, 16, nec pl. vi. fig. 1); 3, t. vii. figs. 3 b, 3 c) figured and described in 1874 from Itaituba and Pedra de Barco, is represented in the present collection by two pedicle-valves. The transversely subquadrate shape, the strongly swollen pedicle-valve with a weak, broad, median flattening or depression and rather steeply descending lateral slopes, the produced and subtriangular rounded, projecting, gently convex ears not clearly marked off from the body, the long hinge-line forming the widest part of the shell, the broad incurved umbo, the narrow, low, rounded radial liræ tending to become weak anteriorly and rarely bearing an isolated hollow spine, and the more or less developed narrow, rounded, concentric rugæ on the umbonal portion producing a reticulated ornamentation are features which are characteristic of the species, and we may note the resemblance to *Pr. boliviensis* D'Orb. as figured and described by Kozłowski (5, p. 36, pl. iv. figs. 13-17) from

the Upper Carboniferous of Bolivia. Derby (1, pl. iv. fig. 13, pl. vi. fig. 1) originally included in his *Pr. chandlessi* a form which is considered by me to be a variety of *Pr. semistriatus* Meek, and we cannot at all agree with his later view (2, p. 493) that some of his specimens should be included in *Pr. peruvianus* D'Orb., which belongs to a different subgenus. Tschernyschew (6, pp. 255, 610, t. lxi. figs. 4a-c, non 1, 2) believed that a certain variety of *Pr. gruenewaldti* Krot., which he described from Russia, was probably identical with *Pr. chandlessi*; and Girty (7, p. 359, pl. iii. figs. 1-3; 4, p. 73, pl. xiv. figs. 15-17) considered that the Colorado form of *Pr. inflatus* McChesney had close affinities with it. *Pr. americanus* Dunbar & Condra (8, p. 218, pl. xxxiv. figs. 3-6) may also be compared. We must at any rate refer *Pr. chandlessi* to Miss Muir Wood's genus (or, preferably, subgenus) *Dictyoclostus*. Huang, in his new classification of the Producti (38, pp. 13, 17), puts *Dictyoclostus* as a subgenus of the genus *Productus*, and this view seems to be satisfactory.

Productus (Marginifera ?) semistriatus Meek
var. nov. *brasiliensis*. (Pl. IX. figs. 1, 1a-c, 2.)

Shell transversely subquadrate, short, strongly inflated; hinge-line equal to width of shell. Pedicle-valve much swollen, arched down steeply in front, but somewhat flattened transversely, having a very faint, broad, median depression and produced into a long trail; body descending vertically on each side of umbonal region to large, depressed, horizontally extended, swollen subtubular ears, well marked off by a deep curved groove. Beak large, broad, incurved, overhanging hinge-line. Surface of valve covered with numerous low, narrow, rounded radial liræ, which become very faint or quite obsolete on anterior region, but a few narrow weak longitudinal folds at irregular intervals are here developed and grow stronger near the margin; umbonal region crossed by numerous regular narrow concentric rugæ producing a fine nodular reticulation. A few small widely scattered hollow vertical spines arise on the radial liræ in the umbonal region, and isolated similar spines are more sparingly scattered over the anterior part of the body; the ears

are smooth except for a few stout spines. Strong undulating concentric growth-striae are present near the anterior margin of the valve.

Dimensions.—

	mm.
Length	32
Width along hinge-line	35
Height	25

Remarks.—This shell is undoubtedly only a variety of *Pr. semistriatus* Meek (14, p. 74, pl. vii. figs. 8, 8a) as figured and described from Utah; its author and King (4, p. 74, pl. xv. figs. 6–11) have regarded it as very similar to *Pr. chandlessi* Derby, but this species has not the ears sharply marked off from the body by a sulcus, and in this feature it also differs from *Pr. boliviensis* D'Orb. Tschernyschew (6, pp. 255, 610, t. lxi. pp. 1, 3, 4, t. lxiii. fig. 3) remarks that certain Russian shells which he figures as a variety of *Pr. gruenewaldti* Krotow cannot be distinguished from *Pr. semistriatus*, but the ears are not marked off so sharply and there seem to be other differences, such as the radial liræ being almost obsolete anteriorly in the Brazilian variety. In *Pr. hindi* Muir Wood (9, p. 108, pl. vi. pp. 3–6, text-figs. 1–5) the peculiarity of the marked separation of the ears is likewise noticeable as in our form, and they are similarly spinose, but the radial liræ are more distinct on the anterior part of the body. Derby (1, pl. iv. fig. 16) figured a specimen of *Pr. semistriatus* var. *brasiliensis* as an elongated form of *Pr. chandlessi*, and Katzer (3, t. vii. fig. 3a) figured it as the type of the latter species. We may note that the Chitichun specimens which Diener (10, p. 32, pl. iv. figs. 11–13, pl. v. figs. 1, 2) figured as *Marginifera typica* Waag. bear a great resemblance to our Brazilian shell, and we may strongly suspect that it should be placed in that subgenus as re-defined by Dunbar & Condra (8, p. 221), though we do not know the internal characters of the brachial valve. King (4, p. 74, pl. xv. figs. 6–11) was inclined to put *Pr. semistriatus* in *Marginifera* on the strength of some specimens from Texas. Huang (38, pp. 19–23), who has made a special study of the marginal ridges of the Productoti, would put *Marginifera* only in a subsection and not even in a subgenus of the genus *Productus*

because of the development of similar internal ridges in many different groups of the Productinæ.

Productus (Linoproductus) cora D'Orbigny.

This well-known species, which was first established on a South American form, is represented by one specimen which shows all the characters of the typical examples from Bolivia, as figured by Kozłowski (5, p. 50, pl. vi. figs. 1-10). Derby (1, p. 49, pl. ii. fig. 17, pl. vi. fig. 17; 2, p. 493) figured it with a query from Brazil, and Katzer (3, p. 164) also recorded it. The specific name has been used in such a wide manner (4, p. 75, pl. xvi. figs. 6, 7), and the synonymies usually given are so varied, that Chao (11, pp. 132-134) seems to have been quite justified in believing that there is need of a minute revision and separation of the many forms included in it. It may be remarked that *Pr. lyelli* De Vern, as figured by Bell (12, p. 111, pl. xvi. figs. 1-5, pl. xiv. fig. 1), from the Windsor formation of Nova Scotia, is a closely allied species. Dunbar & Condra (8, p. 241) would put many of the American forms attributed to *Pr. cora* in *Pr. prattenianus* Norw. & Pratt.

Productus (Juresania) paraensis, sp. n.
(Pl. IX. fig. 3.)

Shell rounded-subquadrate. Pedicle-valve moderately convex, with weak, broad, median depression; cardinal angles obtuse; hinge-line rather less than maximum width of shell; umbo broad, rounded, incurved, rising above hinge-line; umbonal slopes short, steeply descending to slightly flattened, depressed, ill-defined ears, not sharply marked off from body. Surface of valve ornamented with numerous low, rounded, radial liræ of equal size, increasing in number by rare bifurcation and intercalation, about 8-9 in 10 mm, transversely, frequently thickening at fairly regular intervals into small recumbent spine-bases which on the middle and anterior parts of the valve rise up abruptly into short hollow erect spines arranged in irregular quincunx order on every second or third lira. On the umbonal slopes and ears the spines become smaller and much more closely aggregated, and are arranged in concentric rows on the numerous narrow rugæ here developed; on the rest

of the valve the concentric lamellose rugæ are very weak, broad, and almost obsolete, but the fine concentric growth-striæ are distinct.

Dimensions.—

	min.
Length	c. 45
Width	c. 65

Remarks.—This species is represented by only one specimen consisting of a somewhat crushed pedicle-valve with the anterior edge broken and the right cardinal angle forced underneath the body, but the ornamentation is in an excellent state of preservation. It is probably identical with one of the shells which Derby (1, p. 47, pl. iv. fig. 8, non cet.) figured as *Productus semireticulatus* Mart. It seems to be more coarsely ribbed and to have the spinose pustules more regularly distributed than *Pr. amazonicus* Katzer (3, pp. 179, 264, t. vii. figs. 1 a-f), which its founder believed to be probably identical with Derby's specimen just mentioned. We may particularly note the close resemblance of our species to *Pr. (Juresania) nebrascensis* Owen (8, p. 195, pl. xxii. figs. 1-9, 13), *Pr. (Jur.) wilberanus* McChesney (8, p. 202, pl. xxiii. fig. 5), and *Pr. (Jur.) symmetricus* McChesney (8, p. 198, pl. xxii. figs. 10-12) from the Pennsylvanian of various parts of North America. Derby (2, p. 494) recorded a species from Brazil which he thought inseparable from *Pr. nebrascensis*, and it may probably be the same as our new species here described. *Pr. peruvianus* D'Orb. (5, p. 38, pl. v. figs. 1-4) has a subtriangular shape, no dense cluster of spinose pustules on the ears, less continuous radial liræ, and less regularly arranged spinose pustules on the general surface, while concentric lamellose folds are usually absent; and this species, which occurs in the Upper Carboniferous of Peru, Bolivia, and Texas (4, p. 80, pl. xviii. figs. 1-3), is generally put in the subgenus *Buxtonia* along with the closely allied *Pr. porrectus* Kurt; but our Amazonian species is better referred to *Juresania*, although the type-species of the latter, *Pr. juresanensis* Tschern. (6, pp. 276, 320, t. xxix. figs. 1, 2, t. xlvii. figs. 1, 2, t. liii. fig. 4; 11, p. 81, pl. viii. figs. 4-8; 13, p. 107, pl. x. figs. 5 a-c), lacks the erect regularly placed spines and has more marked concentric rugæ. We may also note the probability that *Pr. longus* Meek (14, p. 67, pl. vii. figs. 6, 6 a, b) and

Pr. calhounianus Swallow (15, p. 252, pl. 27, fig. 4, 4 A, B; 8, p. 286) are allied to *Pr. paraensis*, the latter especially resembling it in its spinose ears. *Pr. asperulus* Waagen (16, p. 693, pl. lxxix. figs. 3-6; 17, p. 2) also possesses many similar features. The specimens figured by Kayser (18, p. 182, t. xxv. figs. 5, 6, non 7) from the Upper Carboniferous of China as *Pr. costatus* Sow. bear a great resemblance to our Brazilian species, but they are not Sowerby's British species, as Fliegel, Frech, and Chao have pointed out, and Chao (11, p. 50, pl. v. figs. 1-3, pl. viii. fig. 9) would put them in his new species *Pr. yangtzeensis*. The figures and description of the latter, however, do not agree at all closely with *Pr. paraensis*, and it can hardly be considered to be an allied species. Huang (38, pp. 18, 19) would put *Juresania* as a subgenus of *Pustula* Thomas, to which he gives generic rank.

Productus (Echinoconchus) nevadensis Meek.

Derby (2, p. 494), in 1894, records *Pr. punctatus* Mart. with a query from Pedra do Barco, and remarks that the North American form has been separated by White under the name *nevadensis*, but Schuchert (19, p. 328) gives Meek (14, p. 64, pl. viii. figs. 2, 2 a-e) as the author of this specific name. There is one nearly perfect but somewhat crushed specimen of an elongated pedicle-valve in the present collection, measuring about 50 mm. in length, which completely agrees with *Pr. nevadensis*; the concentric laminae form slightly convex imbricating bands of equal width, and bear on their anterior half 3-4 rows of small, recumbent, slender spines arranged alternately with more or less regularity; the posterior row is usually composed of larger and fewer spines than the other 2-3; the posterior half of each band shows in places very faint, low, radial ridges or recumbent spine-bases of the same nature as the anterior spines, and a few of them occasionally rise into similar spines. In the umbonal region the bands have nearly their whole surface occupied by the recumbent spines. A fine concentric lineation is also present over the whole surface of the valve.

This shell, though closely allied to *Pr. punctatus*, differs slightly in the ornamentation, the posterior half of the bands having a faint radial costation formed by the

recumbent spine-bases, and thereby resembling *Pr. (Ech.) perplexus* Chao (II, p. 76, pl. vi. fig. 13) and some other Chinese species, but *Pr. punctatus* has on the whole a greater resemblance to *Pr. nevadensis*. *Pr. semipunctatus* Shepard (34, p. 153, fig. 9), of the Pennsylvanian, is another species with close affinities. It does not seem possible to agree with Huang (38, p. 18) that *Echinoconchus* Weller is a subgenus of *Pustula*, and if the latter is accorded generic rank such may equally be claimed by *Echinoconchus*.

Productus (Avonia) derbyi, sp. n.
(Pl. IX. figs. 4, 4 a-c.)

Shell small, subhemispherical; hinge-line nearly equal to width of shell. Pedicle-valve very convex, subhemispherical; cardinal angles subrectangular; umbo small, pointed, incurved, projecting over and behind hinge-line; umbonal slopes descending steeply to very small undefined depressed ears; surface of valve ornamented with small, stout, widely spaced, hollow spinose pustules arranged posteriorly in 2-3 obscure concentric rows, with about 8 pustules in each row, but anteriorly the pustules are fewer and irregularly distributed; fine concentric, thread-like, slightly flexuous lines cross the whole valve; hinge-line provided with 6-8 small, closely placed, marginal tubercles on each side of umbo. Brachial valve concave; surface ornamented with small pits and weak pustules.

Dimensions.—

	mm.
Length	9.0
Width	9.5
Height	6.5

Remarks.—There is only one specimen of this species, but it is complete and has the shell still attached to part of the pedicle-valve. It differs from *Pr. subhorridus* Meek (14, p. 75, pl. vii. figs. 3-36) mainly by its fewer pustules or spines and by their bases not being elongated longitudinally; the concentric arrangement of the posterior pustules and the tubercles along the hinge-line are also peculiar. It is somewhat like *Pr. curvirostris* Schellwien (20, p. 51, t. viii. figs. 1, 2; 21, p. 26, t. iii. figs. 12-14); but Tschernyschew's (6, pp. 269, 316, t. xxxix. fig. 3)

figures of Russian examples of that species more resemble our shell. Enderle (35, p. 77, t. xii. fig. 5) has also figured examples of it from Asia Minor, but the variety *barrealensis* Reed (36, p. 133, pl. xiii. fig. 4), from the Upper Carboniferous of Argentina, is quite different, being more elongated in shape and having the ears more sharply marked off from the body. *Pr. (Avonia) subhorridus* Meek, as figured by King (4, p. 84, pl. xx. figs. 10, 11), from Texas, seems to be more nearly related to our species than any other. We may suspect that *P. khmerianus* Mansuy (24, p. 17, pl. vi. figs. 3 a-d), from the *Productus* Limestones of Cambodia, has also close affinities. The British Lower Carboniferous species *Pr. (Avonia) youngianus* Dav. (9, p. 26, pl. xii. figs. 6-10), which is the genotype, is less closely allied. Huang (38, p. 16) expresses the opinion that *Avonia* may simply represent a modified type of *Krotovia*. The figures of certain of the shells from Nebraska which Dunbar & Condra (8, p. 258, pl. xxxii. figs. 1-3, non 4, 5) term *Cancrinella boonensis* (Swallow) appear to be much like our specimen, but Swallow's original description, which they quote, does not agree with it, for there are no "fine regular rounded longitudinal costæ" or "larger irregular concentric rugæ," and the genotype of *Cancrinella* (*Pr. cancrini* De Vern.) is completely different. The young examples of *Pr. villiersi* D'Orb. from Bolivia figured by Kozłowski (5, pl. ii. figs. 44-60) may also be compared, and the small species from Texas which King (4, p. 86, pl. xxi. figs. 19-21) figures and describes as *Marginifera cristobalensis* Girty, and says is very similar to the above-mentioned *Pr. (Avonia) subhorridus* (Meek), is much like our shell, but its generic reference may be doubted.

Orthis (Rhipidomella) penniana Derby.

Examples of this species (1, p. 29, pl. iii. figs. 1-7, 9, 11, 34, pl. iv. figs. 6, 14, 15) occur in the present collection. It is closely allied to *O. (Rh.) cora* D'Orb. from Bolivia, as Kozłowski (5, pp. 64-67, pl. ix. figs. 35-60) has remarked, although Schuchert and Cooper (23, p. 143) put the latter species in *Schizophoria*; but the brachial valve in *O. penniana* differs in having a weak median sinus and the greatest width of the shell is towards the front, the hinge-line being only about one-third the

maximum width of the shell. *O. (Rh.) carbonaria* (Swallow), from the Pennsylvanian of North America (8, p. 52, pl. ii. figs. 1-4), has a less subovate shape and no sinus or only a much weaker one. Haug (22, p. 795, pl. xiv. figs. 1-5) has figured an apparently identical shell from the Sahara under the name *R. michelini* L'Év. King has remarked on certain resemblances in configuration and size which his new species *Rh. hessensis* (4, p. 43, pl. i. figs. 2-4) from Texas bears to *Rh. penniana*.

Orthis (Schizophoria) resupinata Martin,
cf. var. *latirostrata* Toula.

This species, which is represented by one complete specimen, was not recorded from the Amazon by Derby, but Kozłowski (5, p. 63, pl. ix. figs. 86, 87, pl. x. fig. 36) has figured a form from Bolivia, under the name *Sch. resupinata* var. *latirostrata* Toula, with which he considered *Sch. juresanensis* Tschern. to be identical. In our specimen the larger radial lines are disposed at fairly regular intervals apart and have usually three smaller radial lines in the interspaces between them. The umbones of the two valves are closely pressed together, hiding to some extent the small triangular hinge-area on the pedicle-valve. This hinge-area is relatively much smaller than in the Bolivian form, and our shell is thus much like *Sch. supracarbonica* Tschern. (6, p. 593, t. lxiii. figs. 7, 8) of the Russian Upper Carboniferous which Mansuy (24, p. 52, pl. iv. figs. 15 a-f) records also from Indo-China.

Derbya buchi (D'Orbigny).

Certain specimens in the present collection agree with *Derbya buchi* (D'Orbigny) as figured and described by Kozłowski (5, p. 54, pl. viii. figs. 1-6). Steinmann (25, p. 47, text-fig. 41) considers that Derby's *Streptorhynchus hallianus* (1, p. 35, pl. v. figs. 1, 2, 5, 8, 12, 14, 15, 18) from Brazil is identical with D'Orbigny's species, but none of our specimens show radiating folds on the surface in addition to the radii such as Derby describes as present in many of his specimens and as Tschernyschew (6, pp. 200, 576, t. li. figs. 4-6) shows in the Russian shells which he attributes to Derby's species. Licharew (26,

pp. 121, 133) has recently alluded to this plication as showing much variability within the limits of the species. King (4, p. 58, pl. viii. figs. 4-6) figures *D. buchi* from Texas, but does not mention Derby's species in connection with it, and Schuchert (19, p. 414) has kept these species separate.

One of our specimens of a brachial valve calls for special notice because the cardinal process is beautifully preserved, showing the characters figured by Derby and also by Hall & Clarke (27, pl. xi. fig. 12). The cardinal process consists of a pair of slightly divergent and up-turned, long, pointed, subcylindrical hollow processes fused at their base, and each consisting of slightly twisted split tubes or narrow enrolled plates which project at right angles to the plane of the valve and have an independent small nodose swelling at their base on the hinge-line.

Spirifer condor D'Orbigny, var. 1.

This specific name appears to have been applied to several types of *Spirifer* from various parts of the world, but we may doubt if they all belong to the same species as the original South American form described by D'Orbigny. The species is even frequently included in *Sp. cameratus* Morton. King (4, p. 113, pl. xxxv. figs. 8-10, pl. xxxvi. fig. 1) states that the specimens from Texas which he refers to *Sp. condor* agree perfectly with those described under this name by Meyer (28, p. 604, text-fig. 1 A, 1 B) and Kozłowski (5, p. 67, pl. i. fig. 1, pl. vii. figs. 10-14) from Bolivia. Derby (1, p. 12, pl. i. figs. 1, 3, 6, 9, 14, pl. ii. figs. 2, 15, pl. iv. fig. 5, pl. v. fig. 11) at first referred the Brazilian shells to *Sp. cameratus*, but later (2, p. 491) to *Sp. condor*, though only one of his figured specimens resembles Kozłowski's *Sp. condor*. Russian specimens from the *Cora* and *Schwagerina* horizons have been referred to this species by Tschernyschew (6, pp. 141, 531, t. xxxviii. figs. 1 a, b, non 2), but we may doubt this identification.

Two nearly perfect pedicle-valves in the present collection show features which led me at first to hesitate to refer them to *Sp. condor*; but if we accept King's recent definition of the species (*op. cit.*) we may at any rate regard them as a variety. One of them shows much

of the interior of the valve as described below. The shell is transversely triangular, more than twice as wide as long, with acutely pointed cardinal angles. The pedicle-valve is moderately convex from back to front and has a small pointed, elevated, incurved beak rising well above the large concave triangular hinge-area which is nearly at right angles to the plane of the valve and is crossed by strong parallel striæ at right angles to the hinge-line; there is also a large median triangular delthyrium; the surface of the valve has a well-marked median sinus which is angulated for most of its length, but its floor becomes rounded and shallower anteriorly. The edges of the sinus are angular posteriorly, but become subangular or slightly rounded anteriorly; there are about 8 riblets in the sinus, of which the outer ones have arisen by division; on the lateral lobes of the valve there are about 20-23 similar but rather broader, closely placed, low riblets of equal size on each side, and they have mostly arisen from 4 or 5 very short, small, subangular, elevated folds near the umbo, which rapidly die out and bifurcate and subdivide to form them. All the riblets are flattened or have only a very low convexity, and thus resemble species of *Choristites*. The same type of fasciulation is found in *Sp. fasciger* Keys. as described in detail by Chao (39, pp. 8-11). The interior of the pedicle-valve shows a pair of thin deltidial apical plates running inwards from the edges of the delthyrium to the floor of the valve, at first convergent, and then bending out so as to form curved vertical lamellæ defining the inner side of the radially striated and pitted ovarian areas, and bounding posteriorly the pair of deeply sunk adductor muscle-scars. Between these plates the shell is much thickened, and this thickening fills the whole apical cavity. We may remark that some of the Russian shells referred by Tschernyschew (6, t. v. figs. 4, 5, non 1-3) to *Sp. cameratus* much resemble our specimens, which are unlike Derby's figured examples of the latter from Brazil; but all these Russian shells are put by Chao in a distinct species, *Sp. orientalis* Chao (39, p. 11, pl. ii. fig 8). The name *Sp. cameratus* Morton has been applied from time to time to more than one type of *Spirifer*, and there has been considerable difference of opinion as to the limits of the species. Girty (40, pl. xxvii.

figs. 24-27) and Dunbar & Condra (8, p. 334, pl. xxxix. figs. 4, 6-9 *b*) have recently discussed its characteristics, but the transversely alate shape of our specimens distinguishes them from the typical *Sp. cameratus*, which according to Girty has a quadrate or pentagonal outline; the low riblets and inconspicuous fasciculation are, however, similar.

Spirifer condor D'Orbigny, var. 2.

There is one strongly alate transverse specimen of a *Spirifer* clearly allied to the typical *Sp. condor*, and it differs from *Sp. cameratus* by its much produced and acutely pointed subtubular cardinal angles (thus resembling *Sp. triplicatus* var. *alatus* Dunbar & Condra (8, p. 332, pl. xxxviii. figs. 11, 12)) and by its more numerous and finer radial riblets. The specimen is somewhat crushed, but it has a rather strongly convex brachial valve with a prominent rounded median fold carrying 14-15 riblets, of which the two median riblets are rather larger than the rest; each lateral lobe has 25-27 rounded or subangular closely placed riblets, of which the inner 10-12 have arisen by the bifurcation or trifurcation of 3-5 short, narrow, angular folds near the hinge-line, which soon die out; the outer 15-17 riblets are rather smaller and do not seem to arise from division of larger ones, and there are no folds on these lateral parts. The pedicle-valve, which is partly broken away on the left side, exposing the spiralia, has a very large, high, sharp beak strongly incurved over the concave, nearly vertical hinge-area; the sinus, which is concave, rounded, and shallow, and is produced into a rather long rounded tongue, carries 11-13 small subequal riblets, which have apparently arisen by division of a few near the beak. There are 25-30 riblets on each lateral lobe, the 2-3 adjoining the sinus being rather larger than the rest; the inner 8-10 arise by bifurcation or trifurcation of 3-4 short, narrow, low angular folds near the hinge-line; the rest of the riblets are smaller and of equal size, and there are no folds on these outer parts. All the riblets are low, rounded, and close together.

Dimensions.—

Length	mm.
Width	c. 30
	65

Spirifer (Neospirifer) triplicatus Hall.

Dunbar & Condra (8, p. 328, pl. xxxix. fig. 5, pl. xli. figs. 1-6) have recently figured examples of this species from Nebraska, and by their definition of its characters we can recognize one nearly complete specimen in the present collection from Brazil which agrees in all essentials, so that there can be little hesitation in thus identifying it. There seems to have been not a little previous confusion of this species with *Sp. cameratus* Morton, but Dunbar & Condra have carefully pointed out the differences. The riblets are bluntly angular or subangular instead of flattened, and the fasciculation is more marked than in the shells above referred to *Sp. condor*, while the shape of the shell is subtriangular and the fold and sinus much less strongly developed. The shell termed *Sp. pseudo-cameratus* Girty (29, p. 644, pl. lvi. figs. 10-15) seems hardly separable as a species from *Sp. cameratus*, but as King (4, p. 116, pl. xxviii. figs. 4-6, pl. xxxix. figs. 1-3) has remarked, it has "commonly a greater relative length, coarser more irregular costæ, and a narrower and lower fold and sinus." In the character of the fold and sinus it approaches our specimen, but not in the ribbing. It seems probable that the specimens from Bolivia figured by Kozłowski (5, p. 70, pl. v. figs. 6-11) as *Sp. cameratus* belong also to *Sp. triplicatus* as now limited.

Spirifer (Neospirifer), cf. costella King.

One nearly complete but somewhat worn pedicle-valve of another species of *Spirifer* differs from *Sp. cameratus* in the absence of all radial folds and of any distinct fasciculation of the riblets, as well as in the greater number and smaller size of the latter. The valve has a transversely triangular shape, about twice as broad as long; the cardinal angles were apparently subacute; the median sinus is subangular in the umbonal region, with sharp raised edges, but rapidly widens anteriorly and becomes concave with the edges broadly rounded; the lateral lobes are gently convex, but flatten somewhat near the cardinal angles; the beak is rather high, pointed and incurved, rising well above the large strongly concave hinge-area, which has the usual large triangular delthyrium. In the sinus there are 12-15 low, narrow,

rounded, equal, closely placed riblets which have arisen by division from 2-3 in the umbonal region; on each lateral lobe there are about twenty-five rather wider low equal riblets which have arisen by division or intercalation. About 4-5 riblets occur in the space of 5 mm. There are no folds near the hinge-line or elsewhere. We may compare this shell with *Sp. (Neospirifer) costella* King (4, p. 115, pl. xxxvii. figs. 1-3), from the Leonard formation of the Glass Mountains, Texas, which its author rightly regards as closely related to *Sp. fasciger* Keys., and he mentions that the fascicles are hardly noticeable in some specimens.

Spirifer (Brachythyris) opimus Hall.

The shells which Derby (1, p. 15, pl. i. fig. 4, pl. ii. fig. 7, pl. iv. fig. 12) and Katzer (3, p. 159, t. iv. fig. 3, p. 164, t. v. fig. 3) figured and described from Brazil as *Sp. opimus* Hall (30, p. 711, pl. v. fig. 3) have generally (7, p. 383, non pl. xxviii. figs. 1 a, b) been referred by later writers to *Sp. rockymontanus* Marcou (37, p. 50, pl. vii. fig. 4), which was considered to be identical, and as a specific name has priority. But Dunbar & Condra (8, p. 320, pl. xli. figs. 10-11 c) have recently re-established Hall's species, pointing out that the ribs are larger and broadly rounded instead of angular; such is evidently the case in some at any rate of the Brazilian shells figured by Derby, and there are two specimens in the present collection which agree in these respects.

Spirifer (Brachythyris) rockymontanus Marcou.

The examples of this species from Colorado which Girty (7, p. 383 (pars), pl. vi. figs. 4-7) describes and figures under this name and those from Nebraska which Dunbar & Condra (8, p. 318, pl. xli. figs. 7-9) separate from *Sp. opimus* Hall agree in all respects with certain specimens in the present collection. The greater angularity, elevation, and smaller width of the ribs, and their more decided lateral curvature as well as their mode of development in the sinus and on the fold, are distinctive features of the species; Dunbar & Condra also mention the concentric growth-ridges and the fine radial striae which are both well seen in our specimens. The shell-substance seems to be finely punctate.

Squamularia perplexa (McChesney).

This well-known species, which has a wide distribution in the Upper Carboniferous of America (8, p. 313, pl. xlii. figs. 5-8), is represented by one perfect specimen, but the spines are not preserved on the surface. Dunbar & Condra (8, p. 311-317) doubt the correctness of the generic reference of this species, but Chao (39, p. 83) describes allied species from China under the name *Squamularia*. Derby (2, p. 491) recorded *Sq. perplexa* from Brazil as *Martinia perplexa*.

Cleiothyridina orbicularis (McChesney).

Three small specimens of an equally biconvex sub-circular species of *Cleiothyridina* occur in the collection; they have no sinus or fold on their surface, but the front margin may be broadly though very slightly sinuated. The surface of the valves is covered with a series of thin, broad, flat, imbricating lamellæ of unequal breadth and spacing, with the margins weakly fimbriated, the bases of the flat spines of the fringes being only preserved. This species cannot be referred to the well-known form *Cl. roiseyi* (Lév.) without unduly stretching the limits of that species, or to *Cl. pectinifera* (Sow.), which Tschernyschew (6, pp. 102, 511, t. xliii. figs. 4-6) has figured from the Russian Upper Carboniferous, and Frebold (31, p. 29, t. vi. figs. 5, 6) recently from Greenland; but we may refer it to *Cl. orbicularis* McChesney, which is a typical Upper Carboniferous shell in America (8, p. 359, pl. xlii. figs. 1-4). Our Brazilian shell is the form which Derby (1, p. 10, pl. ii. figs. 9-12, pl. iii. figs. 15, 21, 29, pl. vi. fig. 16, pl. ix. figs. 5, 6) referred to *Athyris sublamellosa* Hall, which is now generally included in *A. roiseyi*, though with doubtful justification.

Composita subtilita (Hall).

It has been generally considered that *C. argentea* (Shepard) is identical with *C. subtilita* (Hall), and as the former name has priority it has been frequently employed (19, p. 377). But Dunbar & Condra (8, p. 363, pl. xliii. figs. 7-13) do not agree with this view for reasons which appear quite adequate, and we may at any rate doubt if all the shells attributed by Derby (1, p. 7, pl. i. figs. 5, 7, 8, pl. iii. figs. 8, 16, 19, pl. vi. fig. 2, pl. ix. fig. 4) to

C. subtilita belong to one and the same species, though Kozłowski (5, pp. 79–82) includes them all in *C. argentea*. There is, however, in the present collection the well-preserved posterior half of one rather globose shell showing some of the internal structures which agrees closely with the form of *C. subtilita* figured by Meek (14, p. 83, pl. viii. fig. 6) from Nevada. There is no sinus or groove posteriorly on the pedicle-valve of our specimen, and the brachial valve is convex but is most elevated in the middle, the sides sloping down rather steeply from the middle line. The umbonal angle of the pedicle-valve is about 90° and the umbo is swollen and incurved. Internally the spiralia are seen to consist of 15–17 narrow coils.

C. argentea has recently been recorded but not figured from the Upper Carboniferous of Venezuela (32, p. 523).

Composita trilobata Dunbar & Condra.

There is one brachial valve of a species of *Composita* which is not unlike certain examples of the above-mentioned variable species *C. subtilita* (Hall), which Derby (1, p. 7, pl. i. figs. 5, 7, 8) figured from Brazil, and it may be compared with *C. mira* (Girty) (29, p. 646, pl. lvi. fig. 16, 16 a) from the Pennsylvanian of Utah and Texas (4, p. 129, pl. xlv. figs. 3–8), which is a species closely allied to *C. persinuata* (Meek) (14, p. 81, pl. ix. figs. 4, 4 a, b) occurring in Nevada and Texas (4, p. 130, pl. xliii. figs. 18, 19), though it may be distinguished by its less produced anterior end and weaker sinus and fold. Some of the examples of *C. trilobata* Dunbar & Condra (8, p. 372, pl. xliii. figs. 25, 26, non 27–31) from the Pennsylvanian of Nebraska more especially resemble our shell, and there cannot be much doubt that it belongs to this newly established species. It measures 25 mm. in length, 25 mm. in width, and 13 mm. in height. The interior of our specimen is partly exposed, displaying a cardinal process and hinge-plate apparently identical with that of a shell figured by Hall and Clarke (27 a, pl. xlvii. fig. 18) as *C. subtilita*.

Composita mexicana (Hall).

There is another species of *Composita* in the present collection which is represented by two small perfect

Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 37

individuals which differ from *C. trilobata* and *C. mira* in several respects. The umbonal angle is smaller and the beak of the pedicle-valve more pointed and prominent, the umbonal shoulders being slightly concave instead of convex. There is a weak median groove posteriorly on the pedicle-valve which widens anteriorly into a shallow sinus, and the front of the shell is produced into a short rounded tongue. On the brachial valve, which is deeper and more swollen in the middle than the opposite valve, there is developed anteriorly a low, rounded, marginal fold, and the front end of the shell is somewhat truncated. This species agrees with *C. mexicana* (Hall) (33, pl. xx. fig. 2) as figured and described by King (4, p. 128, pl. xliii. figs. 1-11) from Texas, who remarks that there is much variation in this species and that some approach *C. trilobata* and others *C. subtilita*. We may mention also that *C. windsorensis* Bell (12, p. 133, pl. xxi. figs. 7-18) from the Coal Measures of Nova Scotia bears a considerable resemblance to it. One of our specimens measures 17.5 mm. in length, 15.5 mm. in width, and 9 mm. in thickness.

REFERENCES.

- (1) DERBY. Bull. Cornell Univ. Science, vol. i. no. 2, 1874, pp. 1-63, pls. i.-ix.
- (2) ——. Journ. Geol. (Chicago) vol. ii. 1894, pp. 480-501.
- (3) KATZER. Grundz. d. Unteren-Amazonasgeb. 1903, pp. 142-158, 263-268, t. iv.-viii.
- (4) KING. Geol. of the Glass Mtns., Texas, pt. ii. 1930 (Bull. 3042 Univ. of Texas).
- (5) KOZŁOWSKI. Brach. Carb. Supér. de Bolivie. Annales de Paléont. ix. 1914.
- (6) TSCHERNYSCHEW. Mem. Com. Geol. Russ. xvi. 2 (1902).
- (7) GIBBY, Prof. Paper 16, U.S. Geol. Surv. 1903.
- (8) DUNBAR & CONDRÉ. Pennsylv. Brachiopoda, Bull. 5, ser. 2, Nebraska Geol. Surv. 1932.
- (9) MUIR WOOD. Productidæ.—II. 1928 (Mem. Geol. Surv. Grt. Brit., Palæont. vol. iii. pt. 1).
- (10) DIENER. Himal. Foss. vol. i. pt. 2 (Palæont. Indica).
- (11) CHAO. Productidæ of China, pt. 1, 1927 (Palæont. Sinica, ser. B, vol. v. fasc. 2).
- (12) BELL. Mem. 155 Geol. Surv. Canada, 1929.
- (13) OZAKI. Up. Carb. Brach. N. China, Bull. Shanghai Sc. Instit. vol. i. no. 6, 1931.
- (14) MEEK, in King's Geol. Explor. 40th Parallel, iv. 1877.
- (15) BOOS. Journ. Palæont. vol. iii. 1929.
- (16) WAAGEN. Salt Range Foss. vol. i. pt. 4, 1882-85 (Palæont. Indica, ser. xiii.).
- (17) REED. "New Fossils from the *Productus* Limestones of the Salt Range," Palæont. Indica, n. s. vol. xvii. 1931.

- (18) KAYSER, in Richthofen's 'China,' iv. 1883.
- (19) SCHUCHERT. Bull. 87 U.S. Geol. Surv. 1897.
- (20) SCHELLWIEN. Abhandl. k.-k. geol. Reichsanst., xvi. 1900.
- (21) ——. 'Palaeontographica,' xxxix. 1902.
- (22) HAUG. Mission Saharienne, Paléont. 1905.
- (23) SCHUCHERT & COOPER. Mem. Peabody Mus. Nat. Hist. vol. iv. pt. 1, 1932.
- (24) MANSUY. Mém. Serv. Géol. Indochine, vol. ii. fasc. 4, 1913.
- (25) STEINMANN. 'Geologie von Peru' (1929).
- (26) LICHAREW. Ann. Soc. Pal. Russ. vol. viii. 1930.
- (27) HALL & CLARKE. Palaeont. New York, vol. viii., Brach. i. 1892.
- (27 a) ——. Ibid. Brach. ii. 1893.
- (28) MEYER. Neues Jahrb. f. Miner., etc., B. B. xxxvii. 1914.
- (29) Girty, Prof. Paper 111, U.S. Geol. Surv. 1920.
- (30) HALL. Geol. of Iowa, vol. i. pt. ii. 1858.
- (31) FROBOLD. Medd. om Gronland, 84, no. 2, 1931.
- (32) GERTH & KRAUHL. Neues Jahrb. f. Miner., etc., B. B. lxxv. 1931.
- (33) HALL, in Emory's Report U.S. and Mexican Boundary Surv. vol. i. 1857.
- (34) SHEPARD. Amer. Journ. Sc. xxxiv. 1838.
- (35) ENDERLE. Beitr. Palaeont. Oesterr. Ungarns, etc. xii. 1900.
- (36) REED. Public. no. 381 Carnegie Instit. 1927.
- (37) MARCOU. Geol. North America, 1858.
- (38) HUANG. "Late Permian Brachiopoda of S.W. China.—I." (Palaeont. Sinica, ser. B, vol. ix. fasc. 1, 1932).
- (39) CHAO. Carb. and Perm. Spiriferids of China (Palaeont. Sinica, ser. B, vol. xi. fasc. 1, 1929).
- (40) Girty, Prof. Paper 152 U.S. Geol. Surv. 1927, pp. 411-434.

EXPLANATION OF PLATE IX.

- Fig. 1. *Productus* (*Marginifera* ?) *semistriatus* Meek var. nov. *brasilensis*. Pedicle-valve. $\times 1\frac{1}{4}$.
- Fig. 1 a. Ditto. Posterior view of same specimen. $\times 1\frac{1}{4}$.
- Fig. 1 b. Ditto. Lateral view of same specimen. $\times 1\frac{1}{4}$.
- Fig. 1 c. Ditto. Superior view of same specimen. $\times 1\frac{1}{4}$.
- Fig. 2. Ditto. Superior view of another specimen. $\times 1\frac{1}{4}$.
- Fig. 3. *Productus* (*Jurassania*) *paraensis*, sp. n. Imperfect pedicle-valve. $\times 1\frac{1}{4}$.
- Fig. 4. *Productus* (*Avonia*) *derbyi*, sp. n. Pedicle-valve of complete specimen. $\times 2\frac{1}{4}$.
- Fig. 4 a. Ditto. Lateral view of same specimen. $\times 2\frac{1}{4}$.
- Fig. 4 b. Ditto. Brachial valve of same specimen. $\times 2\frac{1}{4}$.
- Fig. 4 c. Ditto. Posterior view of same specimen. $\times 2\frac{1}{4}$.

LVII.—The Genus *Pseudoleptocerus* Ulmer (*Trichoptera*).

By MARTIN E. MOSELY, F.E.S.

[Plate X.]

ULMER, in his description of *Pseudoleptocerus squamosus*, mentions that there are dark brown scales on the anterior wings and gives a figure of one of them in illustration. The remarkable nature of the scaly vestiture of the anterior wings in this genus is, perhaps, worthy of more than a mere passing reference.

Generally speaking, in the Trichoptera, a name derived from the Greek words *τριξ* (a hair) and *πτερον* (a wing)—i. e., hairy-winged,—the name suffices to indicate the distinction between these insects and the Lepidoptera or scaly-winged insects. In the case of *Pseudoleptocerus* the distinction breaks down. But for the neuration and the structure of the mouth-parts, these insects might well be Lepidopterous, and even amongst the moths it would be hard to find examples to excel in beauty the delicate shades of colour and the design that are found among the species of this curious genus.

The scales occur in both sexes; they are arranged in overlapping rows, and are confined to the anterior wings. They are not all of the same character, some being darkly coloured, black or brown with the upper surfaces strongly striated; others are transparent or yellowish gold with apparently no structure at all, but there are isolated white scales, much larger than the rest, dropped here and there sparingly on to the wings like pearls but with striated surfaces. On the lower margin of the wing towards the apex, the white scales are elongated to make a fringe, and interspersed amongst them are long hairs differing from the ordinary pattern of Trichopterous hairs in being striated. There are a few hairs scattered over the wings amongst the scales, and these also appear to be striated; they are not, however, sufficiently numerous to disguise the fact that the clothing of the wing is practically entirely of scales.

The genotype *P. squamosus* was described in the Ann. Soc. ent. Belg. 1905, by Ulmer, from a female type, but subsequently a description of the male was given in the Notes Leyden Mus. 1907, with figures of the genitalia in both sexes. Navás has described a second species, *P. schoutedeni*, found in the Belgian Congo and elsewhere, and he gives a figure of the neuration of the anterior wing, but no adequate description of the genitalia. Through the courtesy of Dr. H. Schouteden, who sent me the type, I have been able to compare it with examples in the British Museum from the Sudan and Uganda, and I now supplement Navás's description with figures and details of the genitalia drawn from the Uganda example in the London Collection. There

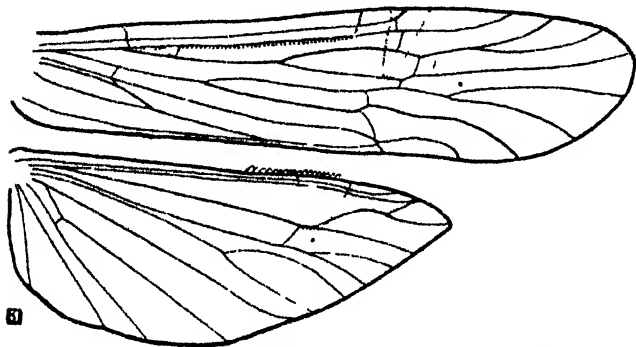
are two other new species in the British Museum Collection, described below as *Pseudoleptocerus njalaensis* and *P. minor*, spp. n. Species in this genus have so far been discovered only in Africa.

Pseudoleptocerus njalaensis, sp. n.

(Pl. X. figs. 1-3; text-figs. 1-5.)

The anterior wing is thickly covered with white and dark brown scales as shown in the photograph (Pl. X. fig. 1). On the membrane there are white patches

Text-fig. 1.



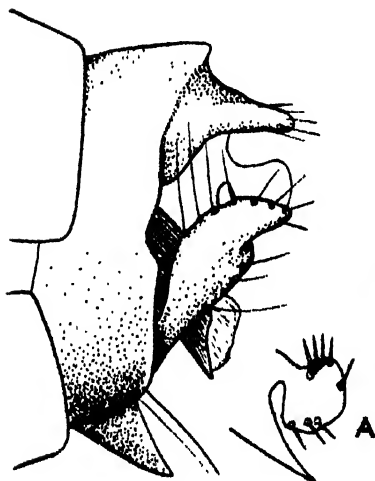
Pseudoleptocerus njalaensis, sp. n., ♂. Wings.

which remain visible even when the wings have been denuded. In *njalaensis* these white patches are as follows: on the anterior wing, at the centre of the upper margin covering both costa and subcosta, there is a long narrow streak. In the undenuded wing, this streak is partly covered by two patches of brown-black scales; towards the basal end of this streak, and below it, is a white spot extending to the sector; there is a large triangular white patch, with the base seated on the costa, terminating on the posterior margin of the discoidal cell towards its apical end; a small oval white mark appears at the base of apical cell 2, and a still smaller oval mark at the base of apical cell 3. In the posterior wing there are three very faint patches towards the apex of the wing, a larger triangular patch based on the costa

and two small oval patches at the bases of the second and third apical cells, that on the third being the longer.

Genitalia, ♂.—From above, the margin of the terminal dorsal segment is slightly produced at the centre. Superior appendages are welded to the terminal segment, so that the line of juncture is not very evident; from above, they form two finger-like processes joined at the base and separated towards the apices by a wide rounded excision; from the side, they are wide at the base

Text-fig. 2.



Text-fig. 3.



Pseudoleptocerus njalaensis, sp. n., ♂.

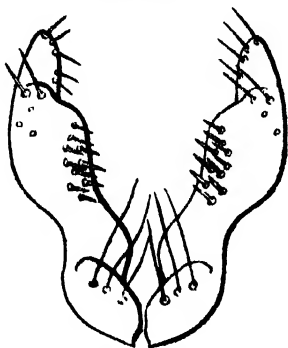
Fig. 2.—Genitalia, lateral. A. Intermediate appendage and upper penis-cover.

Fig. 3.—Genitalia, dorsal.

narrowing to subacute apices, and directed tailward. Below them there appears to be an intermediate appendage welded to an upper penis-cover; the intermediate appendages are fused together, so that, from above, they form a domed plate bearing a line of very stout bristles along the centre; from the side, the appendage is rounded, and there are also two or three bristles arising towards its lower margin. The upper penis-cover is strongly chitinated, and, seen from above, broad and

rounded, from the side, broad at the base narrowing to an acute apex and directed tailward and downward. Penis membranous; beneath it, from below, is a rounded strongly chitinized lower penis-cover. Inferior appendage, from the side, considerably dilated at the centre, the apices being produced at the dilatations so as to make sharp angles at the lower margins; upper margins carrying four or five long strong hairs. Arising at the centre of the terminal ventral segment is a black process very strongly chitinized, from beneath, broad at the

Text-fig. 4.



Text-fig. 5.



Pseudoleptocerus njalaensis, sp. n., ♂.

Fig. 4.—Inferior appendages, ventral.

Fig. 5.—Ventral process.

base with the centre produced in a black finger, its length only slightly shorter than its breadth; from the side, triangular, with an acute apex directed tailwardly and downwardly.

Length of anterior wing, ♂, 5 mm.

Type, ♂, Sierra Leone, Njala, 22. x. 1932 (*E. Hargreaves*).

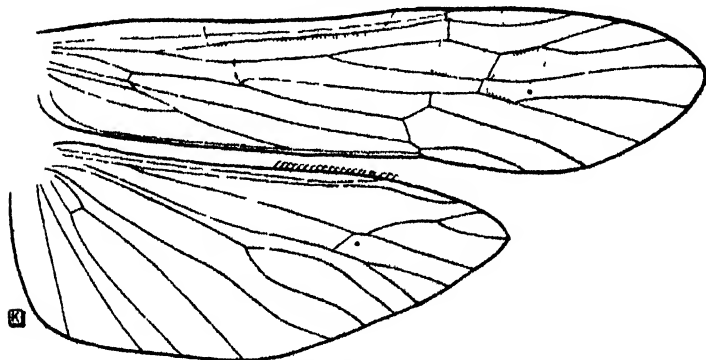
Paratypes, ♂, Sierra Leone, Njala, 21. v. 32 and 25. v. 32 (*E. Hargreaves*); N. Nigeria, Zungeru, Nov. 1910 (*J. W. Scott-Macfie*), in the Collections of the British Museum and presented by the Imperial Institute of Entomology.

Pseudoleptocerus schoutedeni Navás. (Text-figs. 6–10.)

In this species the scales on the anterior wing are coloured mainly light chocolate and yellowish gold,

with a few large white scales sparingly scattered along the main veins and the posterior margin; towards the base of the wing there is a broad band of golden scales stretching from the costa to the posterior margin, sloping diagonally towards the base; next, nearer the apex, there is a second band about equal in breadth, also extending from the costa to the posterior margin, but inclining towards the apex; this band is composed of light chocolate-coloured scales lightly sprinkled with yellow scales; towards the apex, there are various other patches of brown and yellow scales, but their arrangement should be described from an entirely fresh

Text-fig. 6.

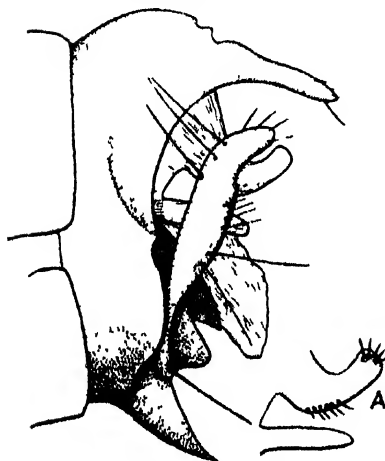
*Pseudoleptocerus schoutedeni* Navás. Wings.

example, as the wings are somewhat denuded in the insect under description; the white markings of the membrane are very similar to those of *njalaensis*, but the two oval patches in the second and third apical cellules tend to coalesce. The markings of the posterior wing are so faint as to be barely discernible.

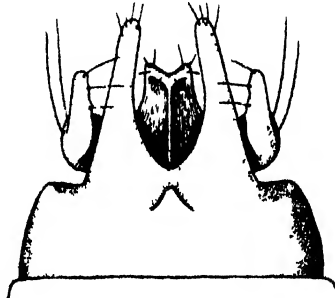
Genitalia, ♂.—From above, the terminal dorsal segment is welded to the superior appendages; towards the centre of the very indistinct line of juncture is a raised triangular platform with a rather acute apex. Superior appendages from above, joined at the base, and produced in very long, rather slender, finger-like processes with round apices armed with stout hairs; from the side,

they curve slightly downward. Intermediate appendages welded together; from above, broad at the base narrowing to a truncate apex which is slightly upturned, it appears excised, and is armed with stout bristles; there is a central ridge marking the line of juncture; from the side, the appendage is bent upwards so that the upper margin is strongly angulated, lower margin convex and armed with a few stout bristles; upper penis-cover from above, very broad at the base, apex slightly produced in a blunt obtuse angle; from the side, straight and finger-like, directed tailward. Penis membranous,

Text-fig 7



Text-fig 8.



Pseudoleptocerus schoutedeni Navás.

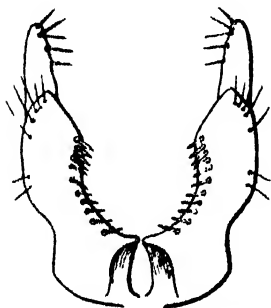
Fig. 7.—Genitalia, lateral. A. Intermediate appendage and upper penis-cover.

Fig. 8.—Genitalia, dorsal.

arching downward; there is a transparent membranous lower penis-cover which, in the example under description, is divided in three parts (possibly fractured). Inferior appendages from the side, long, slightly dilated towards the centre; from beneath, considerably dilated, the dilatation overlapping the terminal portion of the appendage so as to give the false appearance of a second joint; the bases of the appendages are extended in

triangular feet, the apices of which, from beneath, nearly meet; the appendages from beneath are widely divergent, the inner margins towards the lower halves armed with stout bristles. Ventral process very black and triangular; from the side, produced to an acute point; from beneath, very wide at the base and produced at the centre to a rounded apex, the length being considerably shorter than the breadth.

Text-fig. 9.



Text-fig. 10.



Pseudoleptocerus schoutedeni Navás.

Fig. 9.—Inferior appendages, ventral.

Fig. 10.—Ventral process.

Length of anterior wing, ♂ and ♀, 9.5 mm.

Cotypes, ♂ and ♀, Albertville, x. 1925; Ruanda: Bugarama, 29. x. 1925, in the Collections of the Musée de Tervueren.

In the Collection of the British Museum. Albertville, Lake Tanganyika, 770 m., Jan. 1922; Sudan: Zeidab (A. H. Hussein), 7. ii. 28. Shendi (A. H. Hussein), 28. i. 28, 4. ii. 28. Uganda: Jinta, 30. x. (G. H. E. Hopkins) (compared with cotypes), presented by the Imperial Institute of Entomology.

Pseudoleptocerus minor, sp. n. (Text-figs. 11–14.)

The specimen was recieved gummed to a card with all the wing-scales denuded. The white patches marking the membranes of the wings are as follows:—

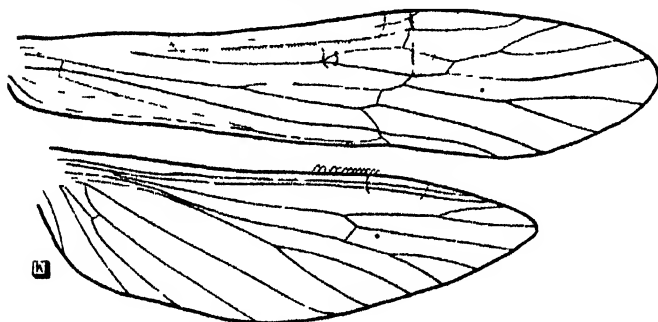
Anterior, a long streak covering costa and subcosta towards the centre of the margin, with a small white patch descending from it and lying across the extreme

basal angle of the discoidal cell; a large triangular patch based on the costa with an acute apex, stretching across the discoidal cell towards its apical angle, reaching its posterior margin; no white patches in the second and third apical cells.

Posterior, a small wide patch, based on the costa towards the apex of the wing, extending not quite down to the sector; no white patches in the second and third apical cells.

Genitalia, ♂.—From above, the terminal dorsal segment is only very slightly produced at the centre. Superior appendages, from above, welded together to make a broad plate with convex sides, and with a wide

Text-fig. 11.

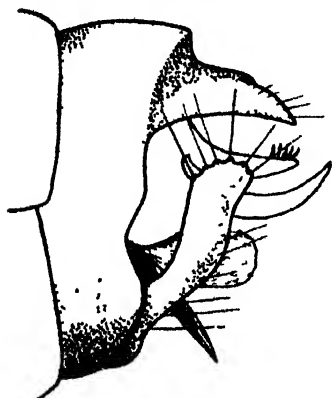


Pseudoleptocerus minor, sp. n., ♂. Wings.

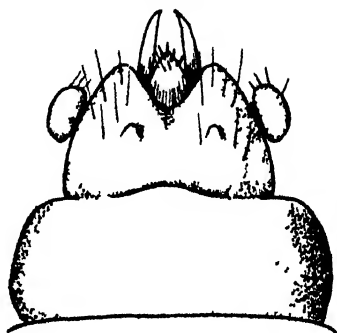
and rather deep excision at the apical margin; as a consequence, there are no finger-like processes as in the other species, the apices of the appendages being broad and rounded; there are two very minute triangular processes arising at the centre of each appendage; from the side, the appendage is rather broad at the base narrowing to an acute apex, upper margin slightly convex, lower margin slightly concave. Intermediate appendages from above, broad at the base, narrowing to a subacute apex, which is armed with a group of stout bristles; from the side, broad at the base, extending tailward in a finger-like process. Upper penis-cover, from above, takes the form of a pair of long yellow spines, apices slightly inturned, from the side, directed

upward. Penis membranous. Lower penis-cover very strongly chitinized, from beneath, broad and rounded; from the side, very narrow and directed downward.

Text fig 12



Text-fig 13



Text-fig. 14

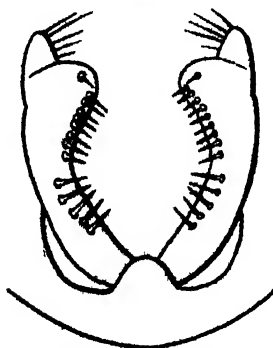
*Pseudoleptocerus minor*, sp. n., ♂.

Fig 12 — Genitalia, lateral.

Fig 13 — Genitalia, dorsal.

Fig 14.—Inferior appendages and ventral process from behind.

Inferior appendages, from the side, directed upward, slightly constricted towards the base and dilated towards the apex which is broad and armed with five or six

long hairs; from behind the appendages have the false appearance of being two-jointed, the apex of the first "joint" being widely dilated inwardly, the inner margins throughout furnished with series of strong short teeth, the terminal "joint" very short, conical, armed along the inner margin with a few strong hairs. There is no strongly chitinized ventral process, but the centre of the terminal ventral segment is produced in a lightly chitinized triangular flap.

Length of anterior wing, ♂, 4 mm.

Type, ♂, a balsam preparation in the British Museum Collections.

Sierra Leone, Njala, 15. xi.—8. xii. 30 (*E. Hargreaves*). Two paratypes, ♂ & ♀, Sierra Leone, Njala, 15 xi.—8. xii. 30 and 1. xi. 32 (*E. Hargreaves*). All presented by the Imperial Institute of Entomology.

The known Species of Pseudoleptocerus Ulmer.

P. squamosus Ulmer. Congo (type), N. Cameroons.

P. schoutedeni Navás. Congo (type), Sudan, Uganda.

P. njalaensis, sp. n. Sierra Leone (type), Nigeria.

P. minor, sp. n. Sierra Leone (type).

REFERENCES.

- ULMER, G. 1905. "Neue und wenig bekannte Trichopteron der Museen zu Brüssel und Paris." *Ann. Soc. ent. Belg.* xlix. p. 21, fig. 5.
 —. 1907. "Neue Trichopteron." *Notes Leyden Museum*, xxix. p. 11, figs. 13–16.
 —. 1907. "Trichoptera." *Genera Insectorum*, fasc. 60 a, p. 136.
 NAVÁS, L. 1930. "Insectes du Congo Belge," ser. iv. *Rev. Zool. Bot. Afr.* xix. 3, pp. 334 5, fig. 49.

EXPLANATION OF PLATE X.

- Fig. 1.* *Pseudoleptocerus njalaensis*, sp. n., ♂. Anterior wing. × 9.
Fig. 2. Scales on anterior wing. × 300.
Fig. 3. Fringe on posterior apical margin. × 300.

LVIII.—*African Bees of the Genus Coelioxys.*

By T. D. A. COCKERELL, University of Colorado.

THE material recorded below was received from the Imperial Institute of Entomology through the kindness of Sir Guy Marshall. All the species, including all holotypes, will be found in the British Museum.

Cælioxys atopura, sp. n.

♂.—Length about 14 mm., anterior wing about 9.

Stout but rather elongate, black, including legs, mandibles, antennæ, and tegulæ, but sides of fourth tergite broadly, and all of fifth and sixth deep red, and venter red beyond third sternite; eyes hairless (character of subgen. *Liothyrapis*); sides of first tergite and a stripe at each side of base of second densely covered with flattened, appressed, narrow, but more or less scale-like hairs. Wings dark fuliginous, hyaline at extreme base. Head and thorax with white hair; short black hair on vertex and at sides of face above; facial quadrangle much longer than broad; front with a strong keel, forked above to include ocellus (as in *C. furcata* Friese); clypeus wholly without a keel, its surface entirely dull, not showing punctures, its upper part with stiff black bristles; scape very short, with short black hair; mesothorax shining (dull posteriorly), with rather weak punctures; scutellum dull, obtusely ridged in middle, and angulate behind; axillæ with rather long slender spines; mesopleura shining; basal nervure meeting nervulus; recurrent nervures received very near base and apex of second cubital cell. Legs with white hair, dense on outer side of hind tibiæ; tarsi with hair on inner face somewhat reddish, but very pale; base of anterior legs with copious pure white hair. Abdomen shining, with rather fine punctures, second and third tergites highly polished in middle; no hair-bands; hind margins of first three tergites narrowly rufous; fifth tergite without lateral angles or teeth; sixth broad, tricarinate, the middle keel ending in a broad hollowed space, the lateral ones diverging and terminating in a sharp dentiform angle; seen from above the hind margin of the tergite appears broadly truncate; in lateral view three teeth appear on each side, the upper one terminating the lateral keels, a longer second one, directed downward, and a small shorter third one beneath and very close to the second; fourth sternite depressed and dull in apical middle.

NYASALAND: Chiromo (*R. C. Wood*). The locality is at the southern end of Nyasaland, not very far from the Zambesi.

Related to *C. furcata* Friese var. *analis* Friese (*arnoldi* Brauns), but distinguished at once by the very dark wings and angulate scutellum.

Cœlioxyx (Liothyrapis) decipiens Spinola.

SUDAN: Wad Medani, 24. i. 1923, in house (*H. W. Bedford*); Wandī, 7. ii. 1911 (*H. H. King*).

Cœlioxyx (Liothyrapis) cherenensis Friese.

SUDAN: Shambat, swarming round head of wheat, 16. ii. 1927 (*Bailey*).

Cœlioxyx (Liothyrapis) cherenensis carpenteri, subsp. n.

♀.—Larger, length fully 15 mm.

Ocelli larger and redder; anterior spots on mesothorax not so large or so sharply defined, connected by a line of pubescence with anterior corners of mesothorax; spots above tegulæ much larger; mesothorax not completely dull, but more or less glistening, with large shining punctures; axillæ with very well developed stout teeth; first two tergites with the apical band narrowly continued right across; fifth tergite without distinct lateral spots; sixth tergite narrower and more produced, with a long apical spine which extends a little beyond end of last sternite; last sternite appearing less broadened, the apparent margin being that of the dark brown fringe. The insect is entirely black, including the antennæ.

UGANDA: Madi, v. 1927 (*G. D. H. Carpenter*).

This is perhaps identical with the "very large female from the Sudan" mentioned by Friese. It has excellent characters, and should perhaps rank as a species, *C. carpenteri*. These *C. cherenensis* forms are related to the northern *C. decipiens*, but more closely to the South African *C. subdentata* Smith, which I have from Matjesfontein (*Turner*).

It would not be unreasonable to treat them as subspecies of *C. subdentata*. *C. subdentata* has a strong keel the whole length of last tergite and has the lateral spots on fourth tergite isolated, widely surrounded by black. The male does not have such distinct round spots on mesothorax. Judging from the description I am not

able to separate *C. lativentroides* Brauns (from Willowmore and Sunday River) from *C. subdentata*.

Cælixys (Liothyrapis) subdentata Smith.

A male has a very obscurely written label, which apparently reads "N. & V., 1928, Fyffe." I compared it with Smith's male type of *C. subdentata*, and noted that the latter differed by having the apical spines much nearer together. I do not know whether we have an individual variation or a representative of one of the closely related species or races.

Cælixys (Liothyrapis) scioënsis Gribodo.

SIERRA LEONE: Makump, Dec. 1926 (*E. Hargreaves*).
KENYA COLONY: Nairobi, iii. 1926; Kyambu, 1921 (*K. E. Dent*); Karura, 14. v. 1920.

A very large species, about 18 mm. long.

Cælixys difformis Friese.

S. AFRICA: Boshof, 14. x. 1926 (*Nel*).

Cælixys barkeri Cockerell.

UGANDA: Madi, v. 1927 (*G. D. H. Carpenter*).
Described from Natal.

Cælixys dolichacantha Cockerell.

UGANDA: Tero Forest, vii. 1912 (*C. C. Gowdey*).
Described from Natal.

Cælixys capensis Smith.

KENYA COLONY: Kabete, 6000 ft., 28. x., 4 and 14. xi. 1918 (*T. J. Anderson*).—Tegulæ all black. S. RHODESIA: Vumba, Umtali, May (*L. Ogilvie*).—Tegulæ largely red.

Cælixys penetatrix Smith.

CAPE PROVINCE: Lady Grey, 8. xii. 1924 (*R. J. Nel*).

This agrees with *C. penetatrix* collected by Dr. Brauns at Willowmore. The typical form of *C. penetatrix* has red tegulæ, red last sternite, and other characters which seem to set it apart as a distinct race. The type-locality is Natal. The Willowmore form has black

tegulae and entirely black abdomen, but the legs are red. More material is needed to determine whether the species as now understood should be subdivided.

Cœlioxyys torrida Smith.

KENYA COLONY : Mombasa, iv. 1928 (*Dr. van Someren*).
TANGANYIKA TERRITORY : Morogoro (*A. H. Ritchie*).

Cœlioxyys somalina Magretti.

NYASALAND : Chiromo (*R. C. Wood*).

This agrees sufficiently with Magretti's description (male only known), except that the spots at sides of tergites 2 to 4 are broadly united with the bands; Magretti seems to imply that they are separate. The eyes have short hair. The apical part of the flagellum is dusky red, with the extreme tip black. It is possible that this southern form is separable, at least as a race, but it is necessary to see more material in order to reach a decision.

Cœlioxyys caffra Frieso.

TRANSVAAL : Louis Trichardt, 4-10. iv. 1932 (*G. Adendorff*), ♀.

This is extremely close to *C. capensis* Sm. (a species Frieso did not know), and could perhaps be considered a subspecies. The last sternite is narrower than in *C. capensis*; last tergite more produced and narrowly pointed, with a little red colour; white hair-stripe at side of sixth tergite about half as broad; sides of thorax anteriorly bare (hairy in *C. capensis*). The eyes have relatively long hair in these species and the last sternite is dark red.

Cœlioxyys cyanura Cockerell.

UGANDA : Tero. BELGIAN CONGO : Elisabethville, Katanga. LIBERIA : Banga (type-locality).

Female 13.3-15.3 mm. long; male 12 mm.

Easily known by the brilliant colours (blue and green) of the abdomen; the legs and mandibles are black.

Cœlioxyys trimerura, sp. n.

♀.—Length about 14.3 mm.

Black, with legs and mandibles (except teeth) dark red; antennae black; tegulae black with a reddish

Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 38

spot; wings deep fuliginous, the base pale; pubescence white, with scale-like hairs on thorax and abdomen; eyes with short hair; a strong shining keel down front and clypeus. Face rather broad; clypeus very finely and densely punctured; middle ocellus on the upper part of a large flattened space; region around ocelli very sparsely punctured; cheeks densely covered with white hair; mesothorax and scutellum very coarsely and densely punctured, shining between the punctures; mesothorax without spots, but two narrow transverse bands of hair between it and scutellum, placed somewhat obliquely; scutellum trigonal, very obtusely subangulate; axillæ with well-developed spines; mesopleura densely white-haired above and along margins, but disc below largely bare; area of metathorax entirely dull; sides of metathorax with long curved pure white hair; basal nervure falling a little short of nervulus; second cubital cell receiving second recurrent nervure a moderate distance from apex, and the first more distant from base. Legs with white hair, pale orange-fulvous on inner side of tarsi; spurs dark red. Abdomen shining, with strong mostly not dense punctures; second tergite with transverse sulcus interrupted in middle; white hair-bands narrow, broadened laterally, second and third tergites with white hair laterally in the sulcus; venter with broad bands; base of second sternite rufous; sixth tergite very finely and densely punctured, broad at base, narrowing to an apical portion which is curved upward and has dark brown hairs at each side of apex; sixth sternite extending some distance beyond, very narrow, curved downward, with short brown hair on each side, the apex minutely bidentate; fifth sternite produced, obliquely truncate apically in lateral view, the abdomen in lateral view appearing three-lobed at end.

KENYA: Nairobi, iv. 1922 (collector's name not given).

A species of the group of *C. argentea* Lep., from which it is known at once by the keeled clypeus. It is allied to *C. luteipes* Friese, which has wings hyaline, smoky at apex, and light red legs and tegulæ; also to *C. cœruleipennis* Friese, which has black legs. The latter agrees in having the strong keel down front and clypeus; the last tergite is elevated at end.

Cœlioxyx lepidospila, sp. n.

♀.—Length about 14.3 mm.

Black, the legs dark reddish; mandibles and antennæ black; tegulæ black with a dark red spot; wings rather dilute fuliginous, hyaline basally; eyes light reddish, with short hair; a strong keel down front and clypeus, in lateral view deeply notched at upper end of clypeus, and on clypeus with a strongly convex outline, like a nose; scutellum at base with two very large light yellow semicircular spots, composed of broad scales; last tergite very long and narrow, gradually (nowhere abruptly) narrowing to end, the basal part shining and sparsely punctured, the apical part strongly keeled; last sternite very long and narrow, sharply pointed, not notched at sides, extending a moderate distance beyond tergite, only slightly curved downward. Clypeus dull, the punctures excessively minute; sides of face with dense white hair; frontal keel with a little pit in middle; sides of vertex with strong sparse punctures; mesothorax dullish, strongly punctured, without spots, but with yellowish scales scattered over the surface, and anteriorly forming a pattern which includes a V-like mark at anterior middle, the arms pointed forward, a poorly defined triangular mark on margin at each side of it, and narrow anterior and lateral margins; scutellum densely rugose, dull, the hind border broadly rounded; axillæ with long spines; metathorax posteriorly with long dull white hair; mesopleura bare below except along margins; basal nervure falling well short of nervulus; second cubital cell receiving recurrent nervures rather distant from base and apex; legs with white hair; abdomen shining, sparsely but distinctly punctured; shoulders of first tergite covered with white hair; bands narrow; sulcus of second tergite interrupted in middle; sides of last two sternites rufescent.

KENYA COLONY: Luni River, Taveta, xii. 1912.

Closely allied to *C. percarinata* Ckll., agreeing in the type of facial keel and caudal structures, but easily separated by the scutellar spots and the mesothoracic pattern. In *C. percarinata* the mesothorax lacks the narrow anterior and lateral marginal band, has no triangular marks, and the V-mark is represented by two

broad faint bands of pale hair, coming together posteriorly, enclosing a much larger triangle, but so obscure as to be readily overlooked. In the British Museum I found *C. percarinata* from Deep Bay, Lake Nyasa, labelled "*carinata* Sm. (*nasuta* Friese)." A smaller one, apparently of the same species, is marked "Zulu." It cannot possibly be *C. carinata*, of which Smith says that the sixth tergite is suddenly narrowed, forming an elongate acute spine. The type of *C. carinata* is in the W. W. Saunders collection at Oxford; I saw it, but made no notes. The type of *C. percarinata* will be sent to the British Museum. As regards *C. nasuta*, when describing *C. percarinata* I gave reasons for considering it different, but the description of Friese is inadequate in respect to several characters now known to be diagnostic, and could nearly be made to apply to *C. lepidospila*. Friese cites no type-locality; I designate as such the first mentioned, Shilouvane, Transvaal.

Cælixys rhombifrons Vachal.

UGANDA: Kampala, 26. xii. 1920 (*H. Hargreaves*), ♀.
Described from Nairobi.

Length about 10.6 mm.; eyes with rather long hair; mandibles largely red, but legs black; a keel down middle of mesothorax; last sternite compressed at sides, so that there is a sort of neck; last tergite truncate. Vachal compares it with *C. obtusa* Pérez, which it closely resembles in the caudal structures. In *C. obtusa* the first recurrent nervure joins the second cubital cell very near the base; in *C. rhombifrons* it is about or almost as far from base as second from apex.

Cælixys neli, sp. n.

♀.—Length nearly to somewhat over 10 mm.

Black, including legs, mandibles, antennæ, and tegulæ, except that the anterior and middle tibiæ apically and all the basitarsi are red; eyes with very long white hair; no keel on front or clypeus; face and front densely covered with long outstanding white hair. Wings dusky hyaline. Abdomen with five entire white bands consisting of scale-like hairs, mostly of narrowly lanceolate form; caudal structures of the general type of *C. acanthura* Illiger, but apical part of sixth tergite

relatively broader and last sternite not nearly so long ; in lateral profile the sixth tergite is very slightly convex dorsally, not concave as in *C. acanthura*. Sides of vertex very finely and densely punctured ; mesothorax and scutellum very densely and rather coarsely punctured, with thin outstanding long white hair ; hind margin of scutellum gently rounded ; axillæ with short thorn-like spines. Legs with white hair ; tarsi with pale fulvous hair on inner side ; red of hind basitarsi obscure. Basal nervure meeting nervulus ; second cubital cell receiving first recurrent nervure rather more distant from base than second from apex. Abdomen shining, sparsely punctured, sulcus on second tergite going right across ; venter with pure white bands ; last sternite long and narrow, sharply pointed, not notched at sides, and not hairy. There are no spots on mesothorax except the usual white hair just behind tegulæ, and at base of scutellum are only two very small and faint whitish marks, easily overlooked.

CAPE PROVINCE : Lady Grey, 10. xii. 1926 (*R. I. Nel*) ; also taken 21. xii. 1923, and 6. i. 1925.

By the hairy face and long hair on eyes this resembles *C. capensis* Smith, but the caudal structures are very different.

Cœlioxya brevis sudanensis, subsp. n.

♀.—Length about 9.3 mm.

Mandibles, antennæ, legs, and tegulæ red ; abdomen red at apex (fifth and sixth tergites, but fifth suffusedly dusky basally) and nearly all of venter ; caudal structures as in *C. brevis*, but last sternite less curved downward and not so long, the portion beyond tergite hardly or not a fifth of length of tergite. The abdominal bands, with more than one scale-row in middle, and the spots at sides of last tergite are as in *C. brevis*, and distinguish it from *C. rufocaudata* Smith, which also has the last sternite narrower and more sharply pointed. The last tergite is acutely keeled except on its basal third. The eyes have extremely short and sparse hair. Face and cheeks with dense pure white hair ; antennæ red above and below, but dusky above at base ; mesothorax spotted all over with yellowish scales and with a broad dense band on each lateral margin ; axillæ with short reddish

spines; wings hyaline, stigma red; basal nervure falling considerably short of nervulus; second cubital cell receiving recurrent nervures equally distant and not far from base and apex; femora beneath and tibiae on outer side with dense pure white hair; first two tergites dusky reddish; sternites 3 to 5 with extremely broad white bands, narrowed and interrupted in middle.

ANGLO-EGYPTIAN SUDAN: Khor Arbaat, 10. v. 1926 (*H. B. Johnston*).

A desert representative of *C. brevis* Eversm., perhaps to be regarded as a distinct species, but more material is desirable.

Cœlioxya brevissima, sp. n.

♀.—Length about 7 mm.

Mandibles, antennae, legs, and tegulae red; abdomen red at apex (last tergite only) and first tergite with an obscure reddish suffusion; venter mainly red; wings hyaline, the apical field dusky, stigma dusky red, nervures fuscous; eyes with short sparse hair; last tergite short and triangular, with a hair-spot on each side; last sternite also short, a little longer than tergite, not bent downward, very broad at base, but the sides narrowing and straight before apex; last tergite not at all keeled, but with a raised rounded margin. Face and cheeks densely covered with white hair, having a faintly yellowish tint; mesothorax dotted with yellowish scales, and anteriorly with three triangular hair-spots, the middle one divided by a line in middle; two separate spots above tegulae; scutellum dull and rough, with rounded margin, its base with two yellowish hair-spots, partly on margin of mesothorax; teeth of axillae long and black; mesopleura densely covered with white hair; basal nervure falling a little short of nervulus; second cubital cell receiving recurrent nervures equally distant from base and apex; abdominal bands slightly yellowish, entire, broadened at sides; in the middle they consist of a single scale-row, with an occasional scale in front, but on first tergite are two rows, the first row of small scales; a hair-spot at each side of first tergite; venter with broad white bands, first sternite with a large white patch in middle and spots at sides; sternites 2 to 5

with the bands leaving a large rounded bare red spot in middle.

ANGLO-EGYPTIAN SUDAN: Hosh, 5. ii. 1923, at light (W. W. Bowen).

Closely allied to the last, but easily known by the short terminal segments of abdomen.

Including the new forms described in this paper and seven others awaiting publication, the species, races, and varieties of *Caelioxys* known from the Ethiopian region number 84. Thus the collection from the Imperial Institute of Entomology includes exactly a quarter of the known forms.

LIX.—*Tanaidacea and Isopoda collected by the Great Barrier Reef Expedition, 1928-29**. By HERBERT M. HALE, Director, South Australian Museum †.

WITH one exception, the specimens described in this paper were taken at Low Isles. The abbreviations indicating localities for these refer to the Key chart given in "The Structure and Ecology of Low Isles and other Reefs," by Stephenson and others, Great Barrier Reef Exped. 1928-29, Sci. Res. vol. iii. no. 2, p. 23. The holotype of *Serolis yongei* was taken at one of the plankton stations outside Trinity Opening.

Order TANAIIDACEA.

Family Tanaidæ.

Genus LEPTOCHELIA Dana.

Leptochelia lifuensis Stebbing.

Leptochelia lifuensis Stebbing, in Willey's Zool. Res. (5) 1900, p. 616, pl. lxiv. C, and pl. lxv. B, and Herdman's Ceylon Pearl Fish., Suppl. Rep. xxiii. 1905, p. 7, pl. i. C; Nobili, Mem. Reale Accad. Sci. Torino, (2) v. 1907, p. 414.

Leptochelia sp. Borradaile, Proc. Zool. Soc. 1900, p. 797, pl. li. figs. 2-2 c.

* The Museum is indebted to Mr. Hale for examining and reporting on this small collection. Owing to the scantiness of the material it is not proposed to include a report on these groups in the series now in course of publication by the Museum.—W. T. CALMAN, Keeper of Zoology, British Museum (Natural History).

† Contribution from the South Australian Museum.

A single female only 1.7 mm. in length; the outer ramus of the uropod is one-jointed, the inner three-jointed.

Loc. Lagoon; small townet (29. ix. 1928).

Suborder FLABELLIFERA.

Family Gnathildæ.

Gnathia spp.

All specimens taken are immature. *G. latidens* Beddard is the only species of the genus recorded from northern Queensland.

Loc. Lagoon; townet (13. xi. 1928) and small townet (29. ix. 1928). Anchorage; small medium townet, night haul, 10 min. 7 A.M., and coarse net (20. xi. 1928).

Family Cymothoidæ.

Subfamily CIRELANINÆ.

Genus EURYDICE Leach.

Eurydice orientalis Hansen.

Eurydice orientalis Hansen, Vidensk. Selsk. Skr. (6) naturv. og math. Afd. v. 3, 1890, p. 369, pl. vi. figs. 2-2 h; Richardson, Bur. Fish. Doc. 736, Washington, 1910, p. 8; Nierstrasz, Mém. Mus. d'Hist. Nat. Belgique, iii. 1930, p. 3, and 'Siboga' Exped. Mon. xxxii. c, 1931, p. 147.

Loc. Anchorage; small medium townet, night haul (1. x. 1928, 5 examples).

Subfamily CORALLANINÆ.

Genus ARGATHONA Stebbing.

Argathona similis Richardson.

Argathona similis Richardson, Bur. Fish. Doc. 736, Washington, 1910, p. 11, fig. 10; Hale, Trans. Roy. Soc. S. Austr. xlix. 1925, p. 162, fig. 16; and *loc. cit.* i. 1928, p. 232 and Crust. S. Austr. ii. 1929, p. 251, figs. 244-245; Nierstrasz, 'Siboga' Exped., Mon. xxxii. c, 1931, p. 175.

A single gorged non-ovigerous female, 17 mm. in length, was taken from a "Coral Cod" (*Epinephelus* sp.). The flagellum of the second antennæ consists of thirty joints and a terminal style, and extends back almost to the level of the posterior margin of the fourth free peræon-segment; it is thus shorter than in other specimens recorded. The palp of the maxillipeds is apparently five-jointed and the first pleon-segment is not concealed.

Loc. Low Is. (8. iii. 1929).

Subfamily *ÆGINÆ*

Genus *ÆGA* Leach.

Æga vigilans Haswell.

Rocinela vigilans Haswell, Proc. Linn. Soc. N.S. Wales, v. 1881, p. 472, pl. xvi. fig. 2.

Æga dubia Richardson, Bur. Fish. Doc. no. 736, Washington, 1910, p. 12, fig. 12.

Æga vigilans Halo, Trans. Roy. Soc. S. Austr. xlix. 1925, p. 174, fig. 23; Nierstrasz, Mém. Mus. d'Hist. Nat. Belgique, iii. 1930, p. 4, fig. 25, and 'Siboga' Exped., Mon. xxxii. c. p. 180.

A single juvenile, 5.4 mm. in length, is referred to this species. The body is relatively wider than in the adult and the antennæ are proportionately longer; the flagellum of the second pair reaches to just beyond the last coxal plate, but is composed of less joints. The flagellum of the first antennæ is ten-jointed, that of the second has twenty-one articles.

The eyes occupy the whole dorsum of the cephalon with the exception of a small V-shaped portion in front; the telson and uropods are much as in the adult.

Loc. Anchorage; small medium townet, night haul (1. x. 1928).

Family *Sphæromidæ*.

Subfamily *SPHÆROMINÆ*.

Genus *PARACILICÆA* Stebbing.

Paracilicæa stebbingi Baker.

Paracilicæa stebbingi Baker, Trans. Roy. Soc. S. Austr. i. 1926, p. 263, pl. xliii. figs. 3-7.

A single male was secured; the two type-examples, a male and a female, were taken at Cooktown, North Queensland.

Loc. On reef (Aust. Mus. staff, 1928).

Genus *CYMODOCE* Leach.

Cymodoce coronata Haswell.

Cymodoce coronata Haswell, Proc. Linn. Soc. N.S. Wales, vi. 1882, p. 190, and Cat. Aust. Crust. 1882, p. 292; Miers, Rep. Zool. Coll. 'Alert,' 1884, p. 306; Hale, Crust. S. Austr. ii. 1929, p. 284.

Three males, each 10 mm. in length. The appendix masculina is half as long again as the ramus and reaches well beyond the fringing hairs of the latter, and the exopod of the uropods is distinctly shorter than the

endopod. The male appendage is relatively much shorter, and the outer branch of the uropods longer in Stebbing's *C. zanzibarensis*.

C. coronata was formerly known only from Southern Australia.

Loc. On reef (Aust. Mus. staff, 1928).

Cymodoce zanzibarensis Stebbing.

Cymodoce zanzibarensis Stebbing, Trans. Linn. Soc. xiv. 1910, p. 105, pl. xc.

Examined and identified by Mr. W. H. Baker, who noted that this species is "closely allied to *C. coronata* Haswell."

Loc. A. 12 (11. iv. 1929).

Family Serolidæ.

Genus SEROLIS Leach.

Serolis yongei, sp. n. (See figure.)

♀.—Body wide, pyriform; dorsal surface almost smooth, with shallow pitting. Cephalon without tubercles on posterior margin, which is slightly sinuate; rostrum short and eyes large and prominent. Second joint of peduncle of first antennæ nearly half as long again as the fourth and four times as long as the third joint, which is very short; the flagellum is four-articulate. Second antennæ longer than the first pair and have the two terminal joints of the peduncle subequal in length; the flagellum is composed of six articles.

Epimera of pereon-segments smooth, not prominently projecting, those of the sixth segment reaching only a little beyond level of anterior margin of caudal shield. Dorsum of sixth segment, as in other Australian species, narrow.

Side-plates of pleon not well developed. Caudal plate two-thirds as long as basal width, with a low median dorsal carina; lateral margins sinuate and apex rounded with extremely slight emargination. The uropods have both branches narrow, the inner ramus longer than the exopod but not reaching nearly to apex of pleon.

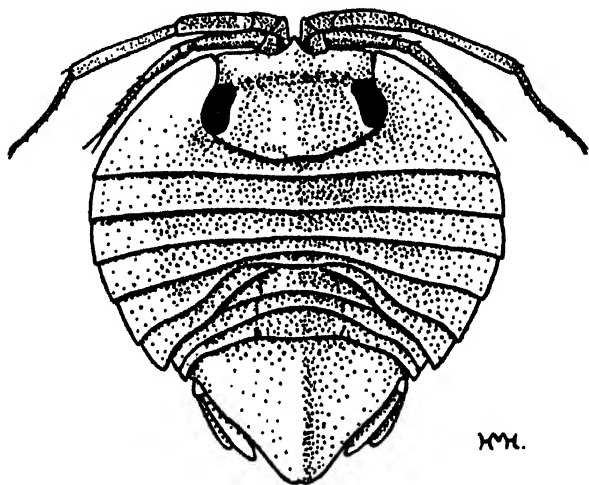
The pereopods and remaining appendages offer no special features.

Length 2.9 mm.; width 2.5 mm.

Holotype in British Museum (Natural History).

Loc. Plankton station 29 (24. xi. 28). Outside Trinity Opening, lat. $16^{\circ} 17' S.$, long. $146^{\circ} 2' E.$ Depth about 200 metres. Bottom stramin-net.

Two examples of this little species were taken. It resembles *S. minuta* Beddard and *S. bakeri* Chilton in the general shape of the pleon, in the characters of the pereopods, etc., but has the caudal shield wider, the side-plates not prominently projecting, no projections from the hinder margins of the pereon-segments, and



Serolis yongei, holotype ♀. $\times 33.$

the antennæ of different proportions. The shape of body and pleon readily separate it from all other Australian species.

Suborder ONISCOIDEA.

Family Ligidae.

Ligia australiensis Dana.

Ligia australiensis Dana, U.S. Expl. Exped. xiii., Crust. 1862, p. 740, pl. xlix. fig. 3; Hale, Trans. Roy. Soc. S. Austr. li. 1927, p. 320, fig. 7.

Loc. I.M. 5 (5. iv. 1929 and 6. iv. 1929).

LX.—On *Anthracocaris scotica* (Peach), a Fossil Crustacean from the Lower Carboniferous. By W. T. CALMAN, D.Sc., F.R.S., Keeper of Zoology, British Museum (Natural History).

IN 1882 B. N. Peach described from the Calciferous Sandstone (Lower Carboniferous) of Eskdale, in Dumfriesshire, a small Crustacean to which he gave the name *Palæocaris scoticus*, referring it to a genus established in 1865 by Meek and Worthen for a species from the Coal Measures of Pennsylvania.

By the kindness of Dr. Pringle I have been permitted to borrow for re-examination the material of *P. scoticus* in the collection of the Geological Survey in Edinburgh. There are nine specimens, of which seven are originals of Peach's figures. The fossils are very obscure *, being no more than very shallow impressions in a black shale, and very little of their structure can be made out. It is possible, however, to say with some confidence that the species cannot be referred to *Palæocaris*, and it is at least doubtful whether it belongs to the same order as that genus. I propose therefore to assign to it a new generic name.

ANTHRACOCARIS, gen. nov. incertæ sedis.

Palæocaris Peach, Trans. Roy. Soc. Edinburgh, xxx. p. 85 (1882); nec Meek & Worthen, Proc. Acad. Nat. Sci. Philadelphia, 1865, p. 48.

Genotype, *Palæocaris scoticus* Peach, l. c.

It is very doubtful whether *Palæocaris landsboroughi* Peach (Monogr. Crust. Carbonif. Scotland, p. 55, pl. viii. figs. 8–10), of which I have examined the holotype, can be referred to this genus.

Anthracocaris scotica (Peach).

Palæocaris scoticus Peach, l. c. p. 85, pl. x. figs. 10–10 h.

Palæocaris scotica Peach, Monogr. Crust. Carbonif. Scotland (Mem. Geol. Survey), p. 54, pl. viii. figs. 1–5 (1908).

Holotype (now selected), specimen in collection of Geological Survey, Edinburgh, Reg. no. M3349 c, original of Peach, 1882, pl. x. fig. 10, and 1908, pl. viii. fig. 1.

* It is possible that the specimens may have deteriorated to some extent in the fifty years since they were examined by Peach. I am unable to see some of the details of structure described and figured by him.

All the specimens seem to be impressions of the dorsal surface, from which it may be inferred that the body was more or less flattened. The most complete specimen measures about 13 mm. in length. The only appendages that are clearly visible are the peduncles of the antennules (each of three segments), in front of the head, and the uropods. The latter consist, so far as can be seen, of a single narrow curved ramus, but the state of preservation makes it impossible to be sure that they were not biramous as described by Peach. They lie on either side of a telson which narrows a little way from the base and seems to be drawn out to a spine-like termination.

The most important feature in which *A. scotica* can be seen to differ from *P. typus* M. & W. (the genotype of *Palaeocaris*) is the presence of only twelve somites (as stated by Peach) between the head-shield and the telson. In other words, assuming that the species belongs to the subclass Malacostraca* the second thoracic somite as well as the first has become incorporated in the head-region. Since the Syncarida may have the first thoracic somite either distinct (*Uronectes*, *Palaeocaris*, Bathynellidæ) or coalesced (Anaspididæ), it might seem a comparatively unimportant matter when this coalescence is extended to another somite. There is some reason, however, for taking this extension rather more seriously. There are, it is true, many cases among Isopoda and Amphipoda in which the division between the head and the second thoracic somite is obscured or obliterated. In these orders the first somite is always indistinguishably fused with the head or is marked off from it by a suture-line, as described by Jackson (P. Z. S. 1926, p. 890) in *Ligia*. In the species that have the second somite added we can trace the stages of anarthrosis in an originally movable joint through the partial to the complete disappearance of the resulting suture. In the order Tanaiacea, however, where the coalescence of the second somite is universal, it is accompanied by the presence on either side of the head-region of a cavity, roofed by a lateral expansion of the dorsal shield, and enclosing the lamellar epipod of the maxilliped. This cavity is plainly homo-

* Although there cannot be much doubt on this point, the actual evidence of Malacostracan affinity hardly amounts to more than the general disposition of uropods and telson and a noticeable diminution in the length of the free somites in passing from the sixth to the seventh.

logous with the branchial chamber of the Mysidacea, Cumacea, and Eucarida. Its presence implies that the disappearance of the first two thoracic somites is due, not to the mere obliteration of dividing sutures, but to the existence of a shell-fold or true carapace overlapping the missing somites and fusing with their dorsal portions, but free at the sides, where it overhangs the branchial chambers.

Peach's figures show, and inspection of the fossils makes still more clear, that the posterior part of the head-shield in *A. scotica* (fig. 1) is expanded on each side into

Fig. 1.

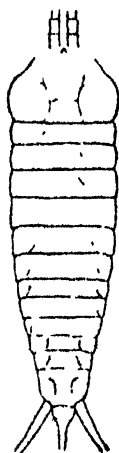


Fig. 2.

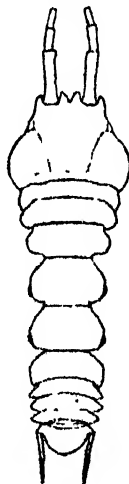


Fig. 1.—*Anthracocaris scotica* (Peach). Partial reconstruction based mainly on the holotype. Total length of body about 13 mm.

Fig. 2.—*Tanais willemoesii* Studer. Dorsal view for comparison with fig. 1. Total length of body 10 mm.

a rounded lobe. Towards the middle line on the dorsal surface a curved groove continues the demarcation of this lobe as an oval or nearly circular area. The anterior part of the head-shield is badly crushed in all the specimens, but it can be seen that the curved groove bifurcates in front, one branch running towards the outer margin

and forming the anterior limit of the lateral area, while the inner branch runs forwards. A transverse groove, incomplete in the middle, connects the two curved grooves behind the middle of the length of the carapace.

The resemblance of this head-shield to that of many Tanaidacea (fig. 2) is sufficiently close to suggest that the lateral areas indicate the position of branchial chambers, and that the head-shield is, in fact, a true though abbreviated carapace.

If this suggestion be accepted it follows that *A. scotica* can hardly be closely related to the recent Syncarida, in none of which can any trace of a carapace be recognized. What its exact position is cannot be determined in the absence of more information as to its appendages, and it would be rash to insist too much on its resemblance to the Tanaidacea. It does not show the abbreviation of the abdominal somites which is characteristic of all existing representatives of that group, and it is further distinguished by the presence of a large telson, probably, though not certainly, separated by articulation from the last somite. The uropods also, although, as already mentioned, their structure is obscure, do not suggest those of any Tanaidacean.

The suggestion that the lateral areas of the head-shield in *A. scotica* indicate the presence of branchial cavities raises the question whether the somewhat similar but less marked postero-lateral inflation of the head-region in the Syncarida *Acanthotelson* * and *Pleurocaris* † may not have the same significance. In both these genera there are seven distinct somites in the thoracic region, so that only the first thoracic somite is incorporated in the head. In none of the recent Crustacea that have only the first thoracic somite so incorporated (e. g., most Isopoda and Amphipoda) is there any trace of a branchial cavity. It is possible, however, that the slight inflation of the head-shield in the Acanthotelsonidæ does actually represent the last vestige of a shell-fold, constituting an intermediate stage between the reduced carapace of *A. scotica* and the complete suppression of the shell-fold which has liberated the first thoracic somite in *Uronectes* and *Palæocaris*.

* Packard, Mem. Nat. Acad. Sci., Washington, iii. pt. 2, p. 124 (1886).

† Calman, Geol. Mag. (5) viii. p. 494 (1911).

LXI.—*New Species of Heterocera in the National Museum.*

By W. SCHAUS.

THE following descriptions are from material obtained from my correspondents, partly as gifts for identification, partly as purchases, and represent a small portion of the new material which has accumulated in recent years. The types, with one exception, are in the National Museum.

*Aretilidæ.**Robinsonia valerana*, sp. n.

Male.—Antenna hair-brown. Palpi and head ochraceous orange. Body white; fore femora buff-yellow; legs mostly white, partly with dark streaks; tarsi hair-brown. Wings silky white. Fore wing: Costal edge and cilia at apex black.

Expanse 36 mm.

Habitat.—Valera, Venezuela.

Type.—Cat. No. 34434, U.S. N. M.

Phæomolis curvenal, sp. n.

Male.—Palpi fuscous, the basal joint, thorax below, and fore femora deep chrome, the legs drab. Head, collar, and thorax deep chrome, the tegulæ outwardly and shoulders hair-brown. Abdomen light orange-yellow with fuscous transverse lines. Fore wing dark brownish drab, the veins on basal half below cell streaked with light greyish buff; three elongated white spots beyond cell below veins 5, 4, and 3, the upper spot longest, the lower spot smallest, the fringe on inner margin white. Hind wing: The basal half from costa to below cell whitish streaked with drab, the white extending to apex; the outer margin broadly deep brownish drab, the inner margin broadly light orange-yellow. Hind wing below light orange-yellow; costa from near base and termen broadly deep brownish drab.

Expanse 46 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34852, U.S. N. M.

Prumala dorisca, sp. n.

Female.—Head, thorax above and below, also legs dusky neutral grey. Collar and tegulæ buff-yellow,

the former with a black dorsal line. Abdomen dusky neutral grey, a lateral maize-yellow patch at base; venter buff-yellow except anal segment. Fore wing buff-yellow; costa, termen, and a narrow line from middle of costa to termen above tornus dusky neutral grey. Hind wing buff-yellow, the outer margin more broadly dusky neutral grey, its inner edge twice outcurved.

Expanse 42 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34381, U.S. N. M.

Differs from *P. ameoides* Butler in the very narrow oblique line of fore wing, and the narrower black costa and termen.

Prumala longilinea, sp. n.

Female.—Palpi fuscous fringed with pale orange-yellow. Frons fuscous shaded with metallic blue. Vertex and thorax fuscous; orange-buff spots in front and behind antennæ. Collar and tegulæ orange-buff outwardly edged with benzo-brown. Abdomen fuscous with dorsal blue spots and lateral metallic-blue segmental lines; a large subdorsal orange-buff spot at base followed by a smaller lateral spot; venter light orange-yellow with fine fuscous segmental lines; some blue scaling on femora. Fore wing benzo-brown, the veins faintly paler; from base below cell to between veins 4 and 5 just beyond cell a broad orange-buff line; a similar terminal spot from above vein 5 to just above vein 6. Hind wing fuscous, the costa light orange-yellow to near apex. Wings below similar, duller; a fine black line on costal margin of hind wing.

Expanse 39 mm.

Habitat.—Valera, Venezuela.

Type.—Cat. No. 34384, U.S. N. M.

Allied to *P. saturata* Walker. Differs in the darker wing and the position of the terminal spot below apex.

Hyponerita ishima, sp. n.

Male.—Palpi scarlet above, light buff below. Head yellow, edged in front and behind with scarlet. Collar and thorax vinaceous-drab. Abdomen dorsally orange-rufous, the terminal segments vinaceous drab. Fore wing: A perilla-purple streak from base along median

vein and upbent to costa enclosing on costa a long triangular maize-yellow spot, edged below by a scarlet line and followed by a very small and narrow spot postmedially; inner margin broadly pale purple-drab with some crimson scales antemedially and postmedially; also a medial crimson annulus filled in with yellow; from vein 2 to costa the postmedial space is light vinaceous purple limited by a perilla-purple line, from termen at vein 7 this line is incurved, angled and inbent below vein 5, then vertical to tornus, and is outwardly edged by a fine crimson line; termen maize-yellow. Hind wing pale orange-yellow. Fore wing below with paler markings.

Expanse 27 mm.

Habitat.—São Paulo, Brazil.

Type.—No. 34438, U.S. N. M.

Nearest *H. incerta* Schaus.

Automolis hoffmanni, sp. n.

Male.—Palpi, frons, thorax, and a line from side of eyes to base of fore wing slate-colour. Vertex, collar, and tegulae maize-yellow. Legs partly streaked with slate-colour, the tarsi black with white bands. Abdomen light cadmium. Fore wing baryta-yellow; basal half of costa slate-colour, reaching median vein and slightly below it at base. Hind wing light cadmium. Wings below the same, but the slate-colour at base of costa on fore wing faintly indicated.

Expanse 33 mm.

Habitat.—Santa Catharina, Brazil.

Type.—Cat. No. 34360, U.S. N. M.

Automolis quinquepunctata, sp. n.

Male.—Palpi, frons, and a medial spot on thorax dark varley's-grey; vertex, collar, tegulae, thorax, and abdomen orange-buff. Body below and legs light orange-yellow, the tarsi partly white with fuscous spots. Fore wing orange-buff, the markings slate-grey; an outbent fascia from base of costa, inwardly excurved, narrow on inner margin; a round medial spot at end of cell, a short streak above it; a small narrow outbent spot at costa well before apex; three subterminal larger spots between veins 5 and 6, 3 and 4, and from vein 2

to tornus. Hind wing light orange-yellow. Wings below orange-buff, the fore wing with the spots black and no fascia at base.

Expanse 36 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34383, U.S. N. M.

Nearest *Automolis tripunctata* Druce.

Automolis valera, sp. n.

Male.—Palpi fuscous above, capucine-yellow below. Head fuscous with lateral orange bands, edged at frons with fuscous and metallic-blue scaling; similar blue scaling between antennæ; collar, tegulæ, and basal half of abdomen capucine-yellow with a dorsal fuscous line from head expanding on two basal segments of abdomen, the terminal segments benzo-brown with metallic-blue dorsal spots. Thorax below fuscous, the legs light orange-yellow with fine benzo-brown streaks; venter on basal half pale orange-yellow with benzo-brown segmental lines, terminally benzo-brown with black segmental lines. Fore wing orange-buff, the apex and outer margin broadly fuscous, diminishing on inner margin to a point not reaching base; before apex an oblique orange-buff spot from vein 7 to below vein 6 almost touching termen. Hind wing fuscous, the costa pale orange-yellow. Fore wing below light orange-yellow, the markings as above. Hind wing below light orange-yellow, the termen more narrowly fuscous.

Expanse 34 mm.

Habitat.—Valera, Venezuela.

Type.—Cat. No. 34385, U.S. N. M.

Automolis gerhilda, sp. n.

Male.—Palpi fuscous fringed with cinnamon-drab. Frons metallic blue. Vertex orange-buff with some metallic-blue scales between antennæ; a fine black line behind head. Collar and tegulæ light orange-yellow edged with black and cinnamon scales. Thorax black, the metathorax with cinnamon and blue scaling. Thorax below fuscous; fore femora light orange-yellow inwardly edged with metallic blue; legs fuscous behind, pinkish in front. Abdomen black with dorsal and lateral

metallic-blue spots; a large subdorsal orange-buff spot at base; venter light orange-yellow with broad segmental black lines, narrower at base. Fore wing benzo-brown, the veins finely pale orange-yellow; from base below cell to vein 3 a broad orange-buff streak with a line from it on submedian fold; an elongated pale orange-yellow spot between veins 5 and 6 beyond cell. Hind wing black, the costal margin to near apex orange-buff, expanding somewhat below cell; the black on inner margin extending to base. Wings below the same.

Expanse 39 mm.

Habitat.—Dos Puentes, Ecuador.

Type.—Cat. No. 34387, U.S. N. M.

Automolis fafner, sp. n.

Male.—Palpi benzo-brown with a fine light buff line in front. Head light orange-yellow, behind orange, dorsally rubbed, laterally light orange-yellow. Thorax and tegulae blackish slate; a dorsal white line; tegulae edged and divided by fine white lines. Abdomen black; a lateral light orange-yellow fascia separated by a black line from the light orange-yellow venter; the anal segment and hairs black. Thorax below and legs deep neutral grey, the legs streaked with whitish, the fore femora largely orange-buff. Fore wing fuscous, the veins on basal two-thirds drab-grey; a broad postmedial pale orange-yellow fascia from costa to tornus, its outer edge slightly outcurved, becoming narrower towards tornus. Hind wing black. Wings below duller, the veins on fore wing not drab-grey.

Expanse 40 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34386, U.S. N. M.

Hyperthæma elysiusa, sp. n.

Female.—Head, thorax, and terminal half of abdomen fuscous-black, basal half of abdomen cinnamon-drab; body below and legs black. Fore wing dusky brown, the veins and margins darker. Hind wing somewhat hyaline pale ecru-drab, the veins and termen light cinnamon-drab; apex and cilia benzo-brown. Fore wing below dusky brown, thinly scaled in and below

cell. Hind wing below largely suffused with cinnamon-drab, darker at apex and on termen.

Expanse 68 mm.

Habitat.—Azoques, Ecuador.

Type.—Cat. No. 34365, U.S. N. M.

Received from Prof. F. Campos.

Ammalo girardi, sp. n.

Male.—Palpi deep brownish drab. Head, collar, and abdomen warm buff; the latter with dorsal black points. Thorax warm buff mottled with tilleul-buff hairs. Fore wing light pinkish cinnamon, the inner margin and termen suffused with cinnamon-buff; below costa a narrow clay-colour shade expanding at apex. Hind wing whitish buff, somewhat hyaline, the termen tinged with pale yellow. Fore wing below paler, the termen broadly suffused with light pinkish cinnamon. Hind wing below as above.

Expanse 33 mm.

Habitat.—Tucuman, Argentina.

Type.—Cat. No. 34403, U.S. N. M.

Named for its discoverer, P. Girard.

Glaucostola reimana, sp. n.

Male.—Palpi ochraceous-orange. Frons white edged above with black; vertex and neck ochraceous-orange, with some black on vertex. Collar white edged behind with black. Thorax white with black spots; tegulae deep chrome. Abdomen above light orange-yellow. Body below and legs white. Fore wing white; costal edge black on basal third; a black basal line; a circular black line below cell from beyond base to middle of wing, proximally broken, edged above and outwardly to submedian with cadmium-orange and crossed within circle by a cadmium-orange line below submedian to near base; some similar scaling below costa to a black antemedial spot; and from this point a black line is downcurved and forms a semicircular line to postmedial space, followed from costa to vein 5 by cadmium-orange outwardly limited by an incurved black line; from lower angle of cell an incurved black line limits the cadmium-orange space following the circular line and ends on inner margin close to tornus; a short black streak

on termen between veins 5 and 4. Hind wing pale orange-yellow. Fore wing below pale yellowish buff; a faint dark postmedial line incurved below lower angle of cell, better defined on costa, with a short black incurved line beyond on costa and a light orange-yellow shade between them. Hind wing below as above.

Expanse 35 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34388, U.S. N. M.

This species differs from *Glaucostola* in having veins 6 and 7 on hind wing stalked, in which it agrees with *Haemanota*, but the pectinated antenna and fovea on under side of fore wing agree with *Glaucostola*.

Described from two males and a female.

Glaucostola pardea, sp. n.

Male.—Very similar to *Glaucostola reimana*; the medial white spot is more elongate, the black line edging it not downcurved; the entire space beyond the post-medial line is hair-brown crossed by faint whitish veins, except the termen which remains narrowly white, only expanding slightly at apex and tornus; there is no trace of the black streak below vein 5. Hind wing somewhat darker than in *Glaucostola reimana*.

Expanse 35 mm.

Habitat.—Buena Vista, Colombia.

Type.—Cat. No. 34389, U.S. N. M.

Described from one male and two females.

No variation is shown in the two species.

Pelochyta songoa, sp. n.

Male.—Palpi fuscous, the third joint hair-brown. Head, collar, and thorax fawn-colour. Abdomen: Base and long dorsal hairs avellaneous; terminal half army-brown with vinaceous-buff lines; underneath cinnamon-drab. Fore wing light buffish avellaneous, with slightly darker markings, all very faint and inconspicuous; fine striæ thinly spread over surface; subbasal and antemedial annuli below cell; an outcurved line from costa near apex inbent to middle of inner margin, macular below vein 3; the veins marked with darker irrorations expanding at termen. Hind wing semihyaline-white, the termen narrowly suffused with wood-brown. Fore wing below duller. Hind wing below

as above, with the costa narrowly mottled with wood-brown.

Expanse, male, 32 mm.

Habitat.—Rio Songo, Bolivia.

Type.—Cat. No. 34413, U.S. N. M.

Can be placed close to *P. nabor* Schaus.

Pelochyta gandolfi, sp. n.

Male.—Head, collar, and thorax olive-brown; basal half of abdomen drab with long tufts of hairs, terminal half light orange-yellow with transverse black lines; a lateral yellow line to base; venter olive-brown. Fore wing silky dark vinaceous-drab, the veins duller, well defined, also a large lunular line from cell to vein 1; a dusky brown incurved shade on discocellular. Hind wing: Cell and interspaces close to cell white, from below cell to inner margin and termen cream-colour; veins from cell and termen deep brownish drab, the latter broad at apex, narrow below vein 2. Fore wing below dark drab. Hind wing below as above.

Expanse 54 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34414, U.S. N. M.

Named for Alfredo Gandolfi.

Elysius erratum, sp. n.

Female.—Palpi ferruginous above, orange below. Head, thorax, and abdomen light orange-yellow. Fore wing apricot-yellow; a large subbasal russet-vinaceous spot below cell; a similar antemedial elongated spot in cell; a small spot at end of cell, a postmedial series of small spots incurved below vein 5, and somewhat larger below veins 4 and 3; an outer row of small spots parallel with termen, the spot above vein 5 larger, and terminating in a very large spot, somewhat triangular, on inner margin and tornus; a marginal row of small spots, the one at apex somewhat larger; all the larger spots are more or less edged with light coral-red; the small spots are light greyish vinaceous with darker edges.

Expanse 52 mm.

Habitat.—Merida, Venezuela.

Type.—Cat. No. 34380, U.S. N. M.

The species is well figured in Seitz as *E. catenata* Schaus, with which it bears no resemblance.

Ischnocampa huigra, sp. n.

Female.—Palpi laterally fuscous. Head and collar pale pinkish cinnamon. Thorax and abdomen pale pinkish buff, the latter dorsally suffused with fuscous to near anal segment, and with a lateral row of small black spots. Fore wing light pinkish buff, thinly scaled with some light drab irrorations and suffusions, the latter forming indistinct lines, all more or less interrupted; antemedial line very faint, expanding on inner margin; postmedial line broader, incurved below subcostal, outangled at discocellular and inbent; subterminal expanding below costa, below vein 4, and on inner margin. Hind wing semihyaline-white, the margins more thickly scaled, white, narrow on costa and termen, broadly on inner margin; dark marginal and subterminal spots at apex. Fore wing below: An inangled smoky patch at discocellular; subterminal line less distinct; marginal black points on interspaces; cilia with some dark mottling. Hind wing below with costa and termen partly pinkish buff with drab irrorations.

Expanse 37 mm.

Habitat.—Huigra, Ecuador.

Type.—Cat. No. 34411, U.S. N. M.

It is impossible to compare this with any of the described species; the pattern is different from that of any of the thinly scaled species.

Amastus aloniæ, sp. n.

Female.—Palpi fuscous, at the base scarlet. Head white, vertex behind orange-rufous. Collar, tegulæ, and thorax ferruginous; a broad white line along front of collar and base of tegulæ edged behind by a fine black line; tegulæ dorsally with a similar broad line. Abdomen above capucine-yellow, the last two segments black with a drab-grey segmental line, laterally upcurved on the two segments beyond with lateral drab-grey spots; the anus white; a sublateral broad cadmium-orange line separated from the white venter by a fine black line. Thorax below cadmium-orange, also the fore femora; legs drab. Fore wing thinly scaled fawn-

colour, the costa slightly paler; the veins darker; a faint dark shade at end of cell, and a similar broad postmedial wavy shade, outwardly paler edged. Hind wing semihyaline, the margins broadly suffused with vinaceous-buff. Wings below with the margins broadly suffused with avellaneous.

Expanse 80 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34392, U.S. N. M.

Amastus jeritzæ, sp. n.

Female.—Palpi peach-red, the third joint, head, and thorax pinkish cinnamon, the tegulæ with a fine central mikado-brown line. Abdomen above peach-red, the last two segments cinnamon-drab; anal hairs white, extending laterally to base as a fine white line; venter and legs cinnamon-drab; pectus peach-red. Fore wing semihyaline irrorated with cinnamon-buff; costa and termen pinkish cinnamon, the latter inwardly preceded by a broad pinkish-buff wavy band; inner margin light pinkish cinnamon, the submedian vein pinkish cinnamon. Hind wing semihyaline; costa and termen narrowly pinkish buff, the inner margin broadly light pinkish cinnamon. Hind wing below with the costa pinkish cinnamon.

Expanse 70 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34410, U.S. N. M.

Amastus esamenæ, sp. n.

Male.—Palpi hair-brown, laterally on two basal joints scarlet. Frons black; vertex brazil-red; collar deep chrome, edged laterally and in front with black. Thorax scarlet; tegulæ deep chrome, dorsally edged with black broadly tipped with pale drab-grey. Abdomen scarlet; a deep greyish-olive band across preanal segment, upcurved laterally to middle of abdomen, outwardly paler shaded; anal segment deep chrome; a deep chrome sublateral line. Venter greyish olive. Thorax below and femora scarlet; legs greyish olive. Fore wing hyaline, the veins and margins narrowly cinnamon-drab. Hind wing hyaline, the termen narrowly light buff, the cilia ochraceous buff. Hind wing below with fine scarlet scaling above and below costal vein.

Female.—Body simiar to that of the male. Fore wing semihyaline cinnamon-drab, darkest on margins; a slight dark shade on discocellular; a faint subterminal wavy light cinnamon-drab line.

Expanse, male 73 mm., female 75 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34390, U.S. N. M.

Amastus reinona, sp. n.

Female.—Palpi steel-grey, some scarlet at base. Head, collar, and tegulae vinaceous-fawn, the collar edged in front with black; thorax medially sandford's-brown. Thorax below and fore femora peach-red, the legs drab. Abdomen grenadine-red, laterally fuscous divided by a salmon-orange line; terminal segments crossed by two black segmental lines; anal hairs white; venter drab. Fore wing semihyaline in discal area irrorated with pinkish cinnamon, the veins darker; the margins vinaceous-cinnamon; a subterminal fawn-colour shade and similar mottling on termen. Hind wing hyaline, whitish, the termen suffused with light buff; the inner margin with flesh-pink hairs.

Expanse 70 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34391, U.S. N. M.

Halisidota athor, sp. n.

Male.—Antenna with long pectinations, the shaft tilleul-buff, the pectinations avellaneous. Collar and thorax pale smoke-grey, almost white at metathorax. Abdomen above drab with whitish transverse lines between last three segments; base and anal hairs white; body underneath whitish. Fore wing light buff suffused with light drab in cell and between the veins, some darker irrorations defining light buff spots; a small spot at end of cell; a black point at base of veins 4 and 5; an elongated spot above vein 5 from cell; a postmedial and a subterminal series of spots on interspaces. Hind wing whitish almost entirely suffused with light brownish drab below cell and vein 2, above vein 2 with thick streaks from termen between the veins. Fore wing below darker, especially on costa

and termen, the spots more conspicuous, largely suffused with dark scaling. Hind wing below with dark irrorations and less prominent dark shading on termen.

Expanse 55 mm.

Habitat.—Campo Bello, Rio, Brazil.

Type.—Cat. No. 34427, U.S. N. M.

Allied to *H. sablona* Schaus.

Halisidota marimba, sp. n.

Male.—Antenna with long pectinations, the shaft light buff, the pectinations wood-brown. Palpi fuscous fringed with pale ochraceous-buff. Head, collar, and thorax tiller-buff. Thorax below and legs light buff, the latter partly streaked with fawn-colour. Abdomen deep brownish drab; some hairs at base and anal hairs light buff. Fore wing light buff, the veins finely fawn-colour, broadly edged with pale brownish drab, which is also finely dark-edged leaving broad streaks of ground-colour on postmedial space; the median to vein 2 and a streak in cell are merely pale brownish drab; small brownish-drab spots on discocellular; on terminal interspaces long streaks like veins, narrow and pointed basad; termen with a wavy brownish-drab line with a few light buff spots; cilia white. Hind wing buff-white from costa to median and vein 3 with brownish-drab terminal short streaks on interspaces; below cell and vein 3 to inner margin brownish drab; a dark point at lower angle of cell, cilia white. Wings below similar, but more faintly marked.

Expanse 60 mm.

Habitat.—Merida, Venezuela.

Type.—Cat. No. 34394, U.S. N. M.

Allied to *H. falacra* Dognin. The terminal markings are very different.

Halisidota huacina, sp. n.

Male.—Antenna moderately pectinated, the shaft whitish at base, the pectinations cinnamon. Palpi fuscous fringed with pinkish buff. Head, collar, and thorax pale pinkish buff. Abdomen above hair-brown terminally, the dorsum otherwise clothed with drab hairs; anal hairs, abdomen below, and legs pale pinkish buff, the fore coxæ with drab streaks. Fore wing light

buff, with fine cinnamon-drab irrorations; a faint dark point at base of subcostal; transverse lines on costa more distinct postmedially; traces of antemedial and medial double lines, macular in cell; a medial cinnamon shade along inner margin; a black point at lower angle of cell; a faint outcurved double postmedial line on interspaces; three oblique fuscous points from above vein 5 to apex; below vein 5 a double series of fine, indistinct lunules, and faint marginal spots all on interspaces. Hind wing dull cinnamon-drab, the costa light buff, not reaching apex; termen with fuscous streaks on veins; cilia whitish. Fore wing below light buff suffused with avellaneous scales and striae at base and end of cell, also between veins 5 and 6, and subterminally; two irregular benzo-brown streaks at costa postmedially, followed by two finer streaks; the spots from vein 5 to apex darker; the subterminal and marginal lines defining small ocelli on interspaces. Hind wing below with a broad light buff streak below costa not reaching termen, and a small dark spot on costa postmedially; a narrower pale streak below cell expanding from base and not reaching the termen, which is of a brighter cinnamon-drab.

Expanse 42 mm.

Habitat.—Chaquimayo, Southern Peru.

Type.—Cat. No. 34426, U.S. N. M.

This species from the Dognin Collection had been identified by Hampson as *H. huaco* Schaus, but is quite distinct. It is nearest *H. taperana* Schaus.

Halisidota maccessoya, sp. n.

Male.—Antenna wood-brown, moderately pectinated. Palpi, head, collar, and thorax wood-brown. Abdomen above cinnamon-drab with transverse dresden-brown lines, light buff at base subdorsally; anal segment warm buff; an ecru-drab lateral line edged below by a fuscous line; venter cinnamon-drab with pale segmental lines. Fore wing buffy avellaneous largely obscured by wood-brown, the veins brownish drab, vein 2 more broadly so; an antemedial outcurved line, defining paler spots on basal side; a medial series of small dark spots also outcurved; three oblique spots from subcostal across end of cell; a small black spot at lower angle

of cell ; small postmedial spots defined by the wood-brown edging, those beyond cell mottled with black ; similar subterminal spots between veins 2 and 5 ; a wood-brown shade above vein 5 to termen and apex ; irregular dark lines and irrorations on termen ; cilia with some fuscous spots and white tips. Hind wing buffy white suffused with drab except on costa and inner margin ; a small dark spot on termen below vein 6 ; cilia tipped with buffy white ; wings below light buff. Fore wing : A large drab spot at end of cell ; some fine faint dark striae beyond cell to termen and apex. Hind wing : Terminal dark streaks below veins 6 and 7.

Expanse, male 50 mm., female 54 mm.

Habitat.—Amatura, Amazons.

Type.—Cat. No. 34395, U.S. N. M.

Allied to *H. cedon* Druce, but quite distinct.

Halisidota ahysa, sp. n.

Male.—Antenna moderately pectinated. Palpi light buff in front, fuscous behind. Head, collar, and thorax pinkish buff ; some black scales on collar and lines of small black spots on patagia and thorax. Abdomen above dusky drab, terminally vinaceous-fawn, with sayal-brown segmental lines ; a light buff lateral line, edged below with hair-brown ; venter whitish with hair-brown transverse lines. Fore wing pale cream-buff ; costa with small fuscous transverse lines and spots, some of them double ; some similar spots above cell, below costal vein ; basal and subbasal fuscous scaling forming irregular and well-broken lines ; a faint antemedial light cinnamon-drab shade outangled at median and well inbent to inner margin, from the angle a similar broader shade along vein 2 to termen ; a post-medial similar shade inbent from costa to inner margin with a diverging shade below vein 6 terminally upbent to apex, veins from cell finely brownish, vein 2 broadly edged with light drab ; on medial areas scattered irregular dark spots, usually edged with broken lines, above submedian forming elongated spots, all these spots whitish ; some similar larger spots beyond cell before the postmedial line ; a fuscous spot at lower angle of cell below a light drab spot. A subterminal series of whitish spots on interspaces partly edged with dark broken

lines; termen variegated with irregular light cinnamon-drab lines, the terminal edge white; cilia white with black spots at veins. Hind wing almost completely suffused with drab, the costa and apex whitish; a terminal hair-brown streak between veins 5 and 6. Wings below white, the fore wing with faint indications of the markings above, the hind wing with some dark scaling on discocellular, the terminal streak below vein 6 with white centre.

Expanse 40-45 mm.

Habitat.—Province of Rio de Janeiro.

Type.—Cat. No. 34393, U.S. N. M.

Nearest *H. obvia* Dognin, the figure of which in Seitz is unrecognizable.

Halisidota zozinna, sp. n.

Male.—Antenna moderately pectinated. Palpi fuscous fringed with light buff. Frons cinnamon-drab; vertex mottled fuscous and drab; collar and thosax pinkish buff; abdomen above drab; anal hairs and venter white, the latter with fuscous transverse lines on terminal half. Fore wing light buff, the markings mostly light cinnamon-drab; subbasal, antemedial, and medial vertical series of short irregular lines and streaks on interspaces; a small fuscous annulus at lower angle of cell and diffuse markings above it to costa; a postmedial series of small annuli well inbent below vein 5 to middle of inner margin; a double series of marginal fuscous spots on interspaces, towards apex conjoined forming streaks; cilia tipped with white. Hind wing whitish, the inner margin below cell and vein 3 to termen suffused with ecru-drab; a dark shade on discocellular and on termen at apex. Hind wing below with the postmedial markings suffusing.

Expanse 42 mm.

Habitat.—Muzo, Colombia.

Type.—Cat. No. 34398, U.S. N. M.

Nearest *H. leucanina* Felder, all the markings much heavier.

Halisidota taperana, sp. n.

Male.—Antenna moderately pectinated; wings broad, the costa of fore wing well rounded before apex. Palpi fuscous behind, broadly fringed with light buff. Vertex

benzo-brown; collar warm buff crossed by fine benzo-brown vertical lines. Thorax and base and anal segment of abdomen light buff, the dorsum otherwise cinnamon-buff. Fore wing light buff, the veins greyish buff, all irrorated with fine cinnamon-buff scales; very fine wavy benzo-brown streaks across costal margin, towards base punctiform; two superposed fine annuli at end of cell; a black point at lower angle of cell; traces of a fine outcurved antemedial line; some postmedial dark points from costa to vein 5; a small dark point below cell before middle of wing; postmedial points above and below vein 2, and on inner margin; a sub-terminal series of small fuscous lunules, the one above vein 5 inset; cilia light buff with fuscous points at veins. Hind wing light buff, the cell, and interspaces below cell to inner margin, with broad cinnamon-buff streaks; some short dark streaks at apex. Fore wing below more faintly marked, the space below cell without irrorations. Hind wing below pale pinkish buff, the costa broadly irrorated with fine cinnamon-buff scales; some irregular dark lines at apex.

Expanse 46 mm.

Habitat.—South Parana, Brazil.

Type.—Cat. No. 34406, U.S. N. M.

Halisidota tabernilla, sp. n.

Male.—Antenna moderately pectinated. Palpi hair-brown with whitish-buff fringe. Head, collar, and tegulae ochraceous-buff; the tegulae and metathorax mottled with some light buff hairs. Abdomen above ochraceous-buff, underneath white; a sublateral series of cinnamon-brown spots. Fore wing above warm buff, the veins ochraceous-buff, and some similar irrorations; some dark points on costal margin; a fine ochraceous-buff line from costa outbent to a black spot at lower angle of cell, from it a faint ochraceous line to apex; very fine postmedial and marginal dentate lines interrupted by veins. Hind wing suffused with warm buff, the costal margin yellowish white. Wings below light buff; a few faint irrorations on terminal third of fore wing.

Expanse, male 40 mm., female 47 mm.

Habitat.—Canal Zone, Panama.

Type.—Cat. No. 34405, U.S. N. M.

The male collected by A. Busck, the female presented to the Museum by Graham Fairchild.

Allied to *H. angulata* and *H. perdita* Schaus.

Halisidota teffeana, sp. n.

Female.—Antenna with short pectinations, the shaft light buff, the pectinations hair-brown. Palpi fuscous on first and third joints, the second pale pinkish buff. Head and body pinkish buff, the abdomen with transverse black bands dorsally; venter whitish with traces of dark transverse lines. Fore wing pale pinkish buff, the margins suffused with pinkish buff; some minute subbasal spots; a double dark antemedial line on costa with a series of dark points in cell and on interspaces to inner margin; a medial line on costa and a few dark scales in cell; fuscous spots at upper and lower angle of cell, and a smaller spot outset between veins 5 and 6; some postmedial and outer dots on interspaces; marginal small dark spots, the one above vein 5 larger; a terminal dark lunular line; cilia white. Hind wing thinly scaled pale pinkish buff, the inner margin slightly darker; terminal hair-brown spots from vein 5 to apex. Fore wing below without markings on basal half; the marginal spots forming large annuli. Hind wing below as above.

Expanse 44 mm.

Habitat.—Teffé, Amazons.

Type.—Cat. No. 34402, U.S. N. M.

A distinct species.

Halisidota romoloea, sp. n.

Male.—Antenna with short pectinations, light orange-yellow. Palpi, head, collar, and thorax light orange-yellow; small black spots on collar and tegulae. Abdomen light orange-yellow. Fore wing light orange-yellow without markings. Hind wing thinly scaled white, very faintly tinged with pale orange-yellow. Wings below similar, but duller.

Expanse 42 mm.

Habitat.—Passo Quatro, Minas, Brazil.

Type.—Cat. No. 34397, U.S. N. M.

Allied to *H. arenacea* Schaus. The veins not darker; two black points on tegulae, and without the lateral black points on abdomen.

Halisidota philina, sp. n.

Female.—Head and collar ochraceous-buff; a black point on vertex and two on collar. Thorax, tegulæ, and base of abdomen light ochraceous-buff; an ochraceous-buff line on tegulæ. Abdomen warm buff. Fore wing pale orange-yellow; a faint darker streak in cell; a brownish point at end of cell; a faint double postmedial series of brownish points more distinct above veins 5 and 6; a similar subterminal series. Hind wing semihyaline except on margins, which are light buffish yellow, the inner margin broadly so. Hind wing below paler except at apex, the postmedial and subterminal points as above.

Expanse 47 mm.

Habitat.—Campo Bello, Rio, Brazil.

Type.—Cat. No. 34425, U.S. N. M.

Halisidota medara, sp. n.

Female.—Palpi black. Head white. Collar white suffused with ecru-drab. Thorax cinnamon-drab, the tegulæ white; metathorax and base of abdomen with buckthorn-brown hairs. Abdomen above pale smoke-grey with fine black and white segmental lines, the basal half with light cinnamon-drab hairs, the two last segments black, the anal hairs white. Thorax below sayal-brown. Fore wing semihyaline partly suffused with fuscous scaling; veins and costal and inner margins fuscous; termen light cinnamon-drab with fuscous irrorations inwardly edged by a fuscous dentate line. Hind wing semihyaline-white, the veins finely fuscous mottled with white; termen and cilia pale olive-buff. Fore wing below with the costal and inner margins paler, the termen broadly light cinnamon-drab. Hind wing below as above.

Expanse 60 mm.

Habitat.—Guasca, Colombia.

Type.—Cat. No. 34374, U.S. N. M.

Belongs to the group of *H. semifulva* Druce.

Euchlenidia macallia, sp. n.

Male.—Head, thorax, abdomen, and legs hair-brown. Fore wing: Costa narrowly, inner margin more broadly, *Ann. & Mag. Nat. Hist. Ser. 10. Vol. xi.* 40

and terminal third of wing drab; a transverse orange-buff bar at base, followed by an expanding triangular maize-yellow space narrowly edged by a fuscous line, its lower edge sinuous, its upper edge medially and the median vein light orange-yellow. Hind wing orange-buff, somewhat hyaline in and beyond cell; a terminal black streak including cilia at apex and at anal angle. Wings below as above, but the triangular space on fore wing light orange-yellow.

Expanse 36 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34441, U.S. N. M.

Euchlænidia erconvalda, sp. n.

Male.—Head, collar dorsally, thorax, abdomen, and legs chætura-drab; collar laterally and tegulæ orange. Fore wing light raw-sienna; subcostal and median veins fuscous to end of cell; costal edge and a subterminal out-curved fuscous line, inbent below submedian to near base; termen and inner margin below the line mouse-grey. Hind wing deep mouse-grey, somewhat hyaline; cell and costa to end of cell light raw-sienna. Fore wing below suffused with capucine-yellow, the termen chætura-drab. Hind wing below also darker, the broad costal fascia more of a capucine-yellow.

Expanse 39 mm.

Habitat.—Incachaca, Bolivia.

Type.—Cat. No. 34442, U.S. N. M.

The apex and outer margin of fore wing well rounded.

Euchlænidia mamerta, sp. n.

Female.—Body above and legs chætura-drab with some dark metallic-blue scaling; body below hair-brown. Fore wing: Basal third neutral grey, the costa to within cell and the median vein black; on inner margin the neutral grey extends to near termen; medially a large zinc-orange spot extends from the costa to near tornus faintly edged by black scaling, its proximal edge obliquely curved, its distal edge obliquely outcurved from costa, joining the distal edging at submedian; the terminal space deep neutral grey crossed by black veins; cilia black. Hind wing deep neutral grey, the base and inner

margin neutral grey. Fore wing below as above. Hind wing below more of a neutral grey.

Expanse 45 mm.

Habitat.—La Merced on Rio Pastaza below Baños, Ecuador.

Type.—Cat. No. 34444, U.S. N. M.

Euchlœnidia wirthi, sp. n.

Female.—Head and body chætura-drab, faintly suffused with fuscous-blue. Fore wing bluish black; base to before middle of costa and to middle of inner margin mikado-orange, the costal edge, inner margin, veins, and submedian fold with black streaks, the distal edge slightly outcurved; cilia black. Hind wing: Basal half mikado-orange; veins at base finely black; the submedian entirely black, and the submedian fold with heavier black scaling; the veins at terminal space shortly black, which gives an irregular edging to orange space; termen as on fore wing. Wings below as above.

Expanse 40 mm.

Habitat.—Venezuela (?).

Type.—Cat. No. 34443, U.S. N. M.

Collected by Col. Wirt Robinson.

Wings broader than in the other species. In appearance very similar to *Thirmida grandis* Druce.

Monas alonia, sp. n.

Female.—Head, thorax, and abdomen above deep olive-buff, the latter pinkish buff laterally and underneath, the last segment and anal hairs pale pinkish buff. Fore wing pale chamois with brownish suffusions at base and medially below cell; a fine dark subbasal line on costa; antemedial line fine, crossed by short dark streaks on costa and in cell; a fuscous point in middle of cell; a wood-brown postmedial shade slightly outcurved at costa with black points at veins 5 and 6; a somewhat macular dark subterminal shade and some darker shading on termen; cilia buffy brown. Hind wing buffy brown with faint darker medial and subterminal shading. Wings below duller, the markings very similar to those of upper surface.

Expanse 53 mm.

Habitat.—Campo Bello, Prov. Rio de Janeiro, Brazil.

Type.—Cat. No. 34473, U.S. N. M.

Antarctia obscurior, sp. n.

Male.—Antenna benzo-brown. Head and thorax blackish brown, the hairs on tegulæ with paler tips. Abdomen fuscous above, underneath benzo-brown. Fore wing somewhat thinly scaled, benzo-brown, the cilia faintly paler tipped. Hind wing semihyaline-whitish irrorated with hair-brown, the veins finely dark; margins narrowly fuscous; the cell with a large white spot. Fore wing below hair-brown, the costal edge light cinnamon-drab. Hind wing below as above.

Expanse 35 mm.

Habitat.—Guasca, Colombia.

Type.—Cat. No. 34375, U.S. N. M.

Distinguished by the fuscous abdomen and dark fore wing.

Antarctia emerita, sp. n.

Male.—Head and thorax deep brownish drab. Abdomen above and laterally ochraceous-orange, traces visible through the thick dorsal hairs of black segmental lines; underneath deep brownish drab. Fore wing slightly paler than the thorax, the veins not conspicuous; a dark streak on discocellular. Hind wing: Basal half buff-white; inner margin pale ochraceous-orange; terminal half suffused with dull brownish drab. Fore wing below dull brownish drab. Hind wing below: Costal margin and termen dull brownish drab, the latter broadly so; basal half below costa whitish with some yellow suffusions.

Expanse 33 mm.

Habitat.—Villa Rica, Paraguay.

Type.—Cat. No. 34450, U.S. N. M.

Allied to *A. fusca* Walker.

Antarctia amarga, sp. n.

Male.—Antenna wood-brown. Head and thorax clove-brown. Abdomen dorsally fuscous consisting of long hairs turned down laterally where they are broadly cadmium-yellow; venter dark grey with broad black segmental lines. Fore wing raw-umber with faint traces of a postmedial line. Hind wing white, the inner margin

narrowly light orange-yellow; termen broadly and unevenly suffused with buffy brown; cilia whitish mottled with buffy brown. Fore wing below hair-brown, the basal third below costa whitish; the base itself with orange-yellow hairs. Hind wing below white; apical half of costa broadly hair-brown, the termen narrowly so; inner margin and base light orange-yellow.

Expanse 30 mm.

Habitat.—Tucuman, Argentina.

Type.—Cat. No. 34449, U.S. N. M.

Antarctia valstana, sp. n.

Male.—Head and thorax fuscous. Abdomen dorsally fuscous, laterally deep chrome, ventrally fuscous. Fore wing army-brown, the base and costa suffused with fuscous; a small black spot at lower angle of cell. Cilia tipped with greyish white. Hind wing white, the inner margin narrowly deep chrome; cilia at apex fuscous mottled with pale smoke-grey. Fore wing below: Costa broadly and termen to vein 2 smoky drab; from cell to inner margin white; some deep chrome hairs at base. Hind wing below as above, but the costa also deep chrome.

Expanse 30 mm.

Habitat.—Tucuman, Argentina.

Type.—Cat. No. 34447, U.S. N. M.

Near *A. nitida* Jones.

Antarctia marcona, sp. n.

Male.—Head and thorax wood-brown. Abdomen above paler. Fore wing fawn-colour, becoming paler terminally; a faint dark line on discocellular. Hind wing white, the margins narrowly suffused with fawn-colour; a fine dark line on discocellular. Fore wing below fawn-colour; a white streak below cell and vein 3; a fuscous spot on discocellular. Hind wing below as above; a fawn-colour spot on discocellular.

Expanse 38 mm.

Habitat.—Castro, Parana, Brazil.

Type.—Cat. No. 34448, U.S. N. M.

Allied to *A. paula* Schaus, larger and with a dark discocellular line on hind wing.

(To be continued.)

LXII.—*New Pyrrhocoridae in the Collection of the British Museum (Natural History)*. By Dr. H. C. BLÖTE, 's Rijks Museum Van Natuurlijke Historie, Leiden.

WHILE examining the very interesting collection of Pyrrhocoridae in the British Museum last year I noticed that several species were still undescribed. Thanks to the kind assistance of the Curator of the Hemiptera, Mr. W. E. China, who afterwards sent me many things I had overlooked, it is now possible to give the descriptions of these species, one of which belongs to a new genus.

Euryophthalmus tricolor, sp. n.

Anterior femora unarmed. Eyes rather prominent. Head black, subequal in breadth to the anterior lobe of the pronotum. Underside almost entirely black, with greyish hairs, only the outer edge of the orifices, the lateral apical corner of the metasternum, a patch at the middle near the hind border of the third and fourth ventral segments, and two large semicircular spots at the apical edge of the sixth ventral segment (of the male) yellow. Ultimate ventral segment of the male with a slight impression in the middle of the edge, at the sides of which the edge is bent somewhat outward.

Pronotum black, with greyish tomentum, lateral and basal borders bright red. Scutellum black, apex brownish. Basal half of the clavus black, shading to brown towards the top. Corium yellow, the basal portion of the outer edge reddish, a rounded black spot on the disk at the base of the membrane. Membrane black, with a sharply defined rather narrow white edge and a brownish basal corner. Antennae and legs black; base of the femora brownish.

Length of the male 10 mm.

Brazil, São Paulo; one male, holotype.

Delacampius hirtus, sp. n.

Head and pronotum brown, shining, the posterior border of the pronotum somewhat yellowish. Scutellum blackish brown, shining. Fore wings very obscure brown, dull, an irregular border along the outer edge and a transverse band which does not reach entirely the inner margin, but joins the outer edge somewhat before the

top of the corium, yellowish. The top of the corium itself is blackish. Membrane very dark greyish brown. The whole upper surface—membrane excepted—is covered with rather long, yellowish, sub-erect hairs. Underside entirely reddish brown, with shining recumbent tomentum. Antennæ brownish, with a sub-basal white annulation at the fourth joint, occupying one-third only of the length of the joint. Rostrum yellow, femora yellowish brown, growing somewhat darker towards the ends. Tibiæ and tarsi yellow.

In general aspect this species is not unlike the other species belonging to this genus, e.g., *D. seria* Bredd., but is easily distinguishable by the yellow transverse band on the corium and the narrow annulation on the ultimate antennal joint. The anterior lobe of the pronotum is relatively narrower and somewhat more swollen; the pronotum does not show any keel-shaped edge at the sides.

Length of the female 9 mm.

Australia, Darwin, N.T. (*G. F. Hill*). One female, holotype, from the Imperial Institute of Entomology.

Physopelta australis, sp. n.

This species is somewhat similar to the African *P. analis* Sign., but is rather larger, and the scutellum, clavus, and corium are nearly as shining as the pronotum. Head blackish brown. Pronotum reddish, the centre greyish brown, but with a slightly elevated longitudinal medial stripe, and the posterior border of the anterior lobe red, so that there are left four more or less quadrangular dark spots. Scutellum and clavus greyish brown. Corium red, a rather large oval spot at the centre and the top greyish brown. Membrane black, without a distinct apical border. Underside brownish black, the anterior border and the centre of the prosternum, all the coxæ and trochanters, the orifices, and the central part of the second, third, and fourth abdominal segments red. Antennæ black, with a narrow, yellowish, sub-basal border to the fourth joint. Legs greyish brown, femora shading to red towards the base.

Length of the female 12–13 mm.

Australia, Darwin, N.T. (*G. F. Hill*); three females (co-types) from the Imperial Institute of Entomology.

Ectatops gracilicornis Stål var. *buruanus*, nov.

Having at my disposal only one female of this form, which is in all respects except for the colour-markings like *E. gracilicornis* Stål, I think it best to describe the form as a variety of that species. The actual relationship with allied forms will possibly appear from the investigation of a male specimen.

The insect shows a yellow spot at the central part of the base of the pronotum, a yellow spot on the disk of the fore wings somewhat before the middle, and, as in the typical form, yellow apical angles of the corium and a yellowish border to the pronotum and at the base of the corium. The top of the scutellum and the base of the membrane, on the other hand, are black.

Malay Archipelago, Buru; one female specimen; holotype of the variety.

Euscopus distinguendus, sp. n.

Within this genus have been described already three species that are in general appearance rather similar to one another; these are: *E. indecorus* Walk., *E. parviceps* Bredd., and *E. stigmaticus* Bredd., which I am convinced are quite distinct species. They differ from each other in the structure of the ultimate ventral segments of the males. In *E. indecorus* Walk., this segment shows a well-marked rounded impression at the centre of the outer edge; the protruding parts at both sides of it show a tuft of somewhat golden shining hairs. On the disk too the segment shows at both sides a patch of laterally directed golden hairs. In *E. stigmaticus* Bredd. the impression is somewhat less deep and shows inwardly a slightly erect lamella. The protruding parts at the sides of it are somewhat callous and directed more outwardly. The tufts of hairs on it are less distinct and partly of a greyish colour; the edge itself is yellowish. In *E. parviceps* Bredd. the impression is much broader, the protruding parts are somewhat angulate, and the disk of the segment shows shortly before the edge a rather deep transverse furrow occupying the whole breadth of the segment. A fourth species, which I am about to describe, has the outer edge of the ultimate ventral segment nearly straight, but shows, like *E. parviceps* Bredd., a distinct transverse furrow on the disk. This species is rather similar to

E. parviceps Bredd., but shows no difference in the colour of the lateral edge of the pronotum and of that of the hemielytra, as both are reddish or orange (faded?). Colour above blackish, the corium at the sides shading somewhat into greyish brown. A smooth white point near the centre of the apical edge of the corium. Thorax beneath and femora black; tibiae and tarsi greyish brown. Antennae black, fourth joint with a sub-basal white annulation occupying a little more than half the length of the joint. Venter red; the incisures, especially laterally, blackish; the sides with a more or less distinct greyish stripe.

Length of the male $8\frac{1}{2}$ mm.; of the female $10\frac{1}{2}$ mm.

Indo-China, Kompong Kedey (V. R. de Salvaza, 1917); one male, holotype. Borneo, Trusan, Nov. 1902 (Distant coll.), one female allotype.

PAJANJA Blöte.

Zool. Med. 's Rijks Mus. v. Nat. Hist. Leiden, xv. p. 263.

Pajanja brevicollis, sp. n.

This species shows the same peculiarities in the structure of the sixth (seventh) ventral segment and in the structure of the prothorax as the species already described from Java. The species is nevertheless easily distinguishable from *P. vandervechti* Blöte by its much broader pronotum, of which the breadth is about two and two-fifths times the length in the middle. The elytra too are more than one and a half times broader than long; the membranal part, on the other hand, is relatively longer than in *P. vandervechti*, occupying about two-fifths of the length of the elytra. The processi on both sides of the lateral edges of the pronotum are larger, reaching about the posterior edge of the eyes. Top of the scutellum slightly raised. Colour reddish brown. The antennae greyish, tibiae and tarsi, a subapical annulation, and irregular markings to the femora, spots on the incrassated genae behind the eyes, and spots on the connexivum at the apical edges of each abdominal segment, yellowish. As in *P. vandervechti* the body is covered with shining golden hairlets, which are in this species still shorter. Rostrum reaching about or a little beyond the posterior margin of the third ventral segment.

Ultimate ventral segment of the male with two teat-shaped processi at the apical edge, two pointed processi near them but somewhat more inwardly, and a nearly rectangular extension at each side of the apical edge.

Length of the male 8 mm., of the female 8½ mm.

S. India, Coonoor, Nilgiri Hills, 5500 feet, May 1915 (Dr. T. V. Campbell); one male and one female, holotype and allotype.

Odontopus obscurellus, sp. n.

Obscure greyish brown. Head shining reddish brown, the vertex somewhat darker. Pronotum, scutellum, and hemielytra dull. Anterior and posterior border to the pronotum, basal fascia to the edge, and a transverse spot before the apex of the corium yellow. Antennæ greyish brown, a sub-basal annulation to the fourth joint, occupying about two-fifths of its length, yellow. Underside reddish brown, the borders of all the segments except the fifth ventral segment yellow. Sterna with yellow spots near the coxæ. Bases of the second, third, and fourth ventral segments red. Legs greyish ochraceous. Ultimate ventral segment of the male reddish, the apical edge without any incisures or extensions, but with a transverse furrow near it on the disk of the segment.

Length of the male 10½ mm.

Rhodesia, Amatongas Forest, Feb. 1917 (P. E. A.); one male, holotype, from the Imperial Institute of Entomology.

Dindymus minutus, sp. n.

In general aspect not unlike *D. rubiginosus* F., but slightly broader and of smaller size. Head and pronotum red, shining; scutellum obscure brown, dull. Hemielytra orange-red, in places yellowish towards the costal edge. Membrane blackish, the extreme basal corner yellowish, the top slightly greyish. Underside red, shining, the posterior borders of the thoracic sternites and stripes along the furrows in the anterior and intermediate coxal cavities yellow. Antennæ obscure greyish brown, the basal part of the fourth joint, occupying slightly more than half of the length of the joint, yellowish white. Femora reddish. Tibiæ and tarsi yellowish brown, the posterior tibiæ somewhat darker.

Ultimate ventral segment of the male without distinct impressions or extensions, only the edge protruded into a very obtuse and rounded angle in the middle, and the disk of the segment flattened, with a very indistinct excavation in the centre.

Length of the male $9\frac{1}{2}$ mm.

Queensland (*F. P. Dodd*), 1907 ; one male, holotype.

Dindymus tenebrosus, sp. n.

Head yellow ; a large triangular spot occupying the vertex and extending in front of the insertion of the antennæ, and the genæ beneath the eyes, black. Antenniferous tubercle reddish. Pronotum black, rather dull, all the edges (the posterior only very narrowly) yellowish. Scutellum and hemielytra dull black, basal part to the outer edge of the corium yellow. Membrane with greyish apical border. Underside of the thorax yellowish, with black spots at the sides of each segment. Venter red, the apical part of each segment yellow in the middle. Antennæ entirely blackish brown. Legs blackish, the coxæ, trochanters, and bases of the femora yellowish. Anterior femora with one large and one or two very small spines beneath. Ultimate ventral segment of the male with a more or less semicircular but somewhat angular incisure in the centre of the apical edge. The edge at the sides of this incisure slightly protruding into rather sharp teeth. The disk with a distinct rounded impression surrounding the incisure of the edge.

Length of the male $12\frac{1}{2}$ mm.

Tanganyika Territory, Keniolo, 4th April, 1925 (coll. *A. H. Ritchie*) ; one male, holotype, from the Imperial Institute of Entomology.

Cenæus obscuratus, sp. n.

Antennæ black, base of the fourth joint yellowish. Anterior femora with two small spines beneath near the apex. Head black, shining, the hind border of the vertex, the very short stalks of the eyes, the underside for the greater part, and spots on the antenniferous tubercles red. Pronotum reddish ochreous, the anterior area black, shagreened ; the anterior border whitish, the anterior parts of the lateral borders red. Scutellum black. Hemielytra reddish ochreous, the basal half of the clavus

black. Membrane black, the base ochraceous, the apical border whitish. Underside black, sides of the prosternum red; the anterior border of the prosternum, posterior borders to the three thoracic sternites, acetabula, and the greater posterior part of all the ventral segments yellow, the fifth segment nearly totally, and the sixth for the greater part black. Legs black; tarsi and apex of the femora with shining golden hairlets. Rostrum black, fourth joint brownish. Ultimate ventral segment of the male with a more or less triangular impression at the apical edge, and with a rather indistinct transverse impression at the disk.

Length of the male 10½ mm., female about the same, somewhat immature.

Sierra Leone, Njala, 4th Aug., 1925 (*E. Hargreaves*); one male, holotype. Njala, 12th Aug., 1926 (*E. Hargreaves*); one female, allotype; both specimens from the Imperial Institute of Entomology.

Cenceus distinguendus, sp. n.

Antennæ black, base of the fourth joint yellowish. Anterior femora with two small spines beneath near the apex. Red; anterior and posterior margin to pronotum, anterior margin of the prosternum, posterior margins of the thoracic sternites, coxal cavities, hind borders of the first four ventral segments broadly, and of the fifth and sometimes of the sixth segment narrowly, yellow. Hemelytra more or less ochreous. The furrows surrounding the anterior area of the pronotum, furrows on the sterna, incisures of the abdomen, base of the fifth (fourth to sixth) ventral segment, scutellum, base of the clavus, and membrane except the base and the apical edge, blackish. Legs reddish brown, coxæ and trochanters red. The structure of the ultimate ventral segment of the male is similar to that of the foregoing species, only the impression at the apical edge is slightly broader, less deep, and less angular in the centre.

In the material belonging to the Imperial Institute of Entomology I found this species from three different localities, each with a somewhat different facies, and it is possible that a study of more material would justify the formation of more species, or at least geographical races; but, as I cannot find any appreciable difference

in the structural characters nor in the structure of the genital segments, I think it best to unite them for the present. Nevertheless, only the specimens from Togoland are regarded as types, to prevent any confusion in the future.

The specimens from Uganda are different in having the prothorax somewhat more trapezoidal and relatively shorter and in having an entirely yellowish venter. The specimens from Nigeria (with the exception of the specimen collected by Mr. F. D. Golding, which is similar to the type) are more regularly oval, relatively narrower, and also lack the black markings on the venter. In both forms often the femora are more or less reddish.

British Togoland, Kpedsa, January 1925 (*G. S. Cotterell*); one male (holotype) and three females (allo- and paratypes). Nigeria, Ibadan, 3rd July, 1922; one male and two females. Ibadan, 1st September, 1924 (*F. D. Golding*); one female, with a label "Attack *Dysdercus supersticiosus* in laboratory." Uganda, Kangai, 1st January, 1911 (*C. C. Gowdey*); one male. Uganda, Kampala, 19th July, 1917; one female. Kampala, 13th Sept., 1918; one female. All the specimens from the Imperial Institute of Entomology.

Myrmoplasta longipennis, sp. n.

This species shows the peculiar structure of head and pronotum characteristic of the African species, and agrees quite well with the genus *Myrmoplasta* in all the characters mentioned by Gerstaecker in his definition of the genus with the exception of the slightly longer hemielytra. I am convinced that this and the following species can be referred to this genus.

Head and thorax, the yellow posterior border of the pronotum behind the constriction excepted, black. Hemielytra reaching slightly before the middle of the abdomen, black, with a transverse yellow band, widened towards the lateral edge and joining it, but not reaching the inner edge of the hemielytra. Antennæ and legs black, trochanters and bases of the femora yellowish. Abdomen ochraceous, the ultimate segment entirely and the penultimate segment partially black. The incisure between the fourth and the fifth dorsal segment with a distinct flexure, so that the fourth segment in the

median line is about four times as long as the fifth, but at the sides they are nearly equal in length.

Length of the female $7\frac{1}{2}$ – $7\frac{3}{4}$ mm.

Tonkin, June 1917 (*R. V. de Salvaza*); one female, holotype. Laos, Xieng Khouang, 11th May, 1919 (*R. V. de Salvaza*); one female, paratype.

Myrmoplasta biguttata, sp. n.

Black, the posterior angles of the pronotum with the adjacent parts of the posterior edge of the sides of the prosternum, a small rounded spot on the scutellum near the apex, two large oval spots near the apex of the hemielytra, joining the costal edge, a large rounded basal spot on the venter, and the base of the connexivum with the adjacent parts of the venter and dorsum of the abdomen yellow. Hemielytra reaching slightly beyond the apex of the third dorsal segment. The incisures between the third and fourth and between the fourth and fifth dorsal segments with flexures, more distinct in the last-named incisure.

Length of the female $6\frac{1}{2}$ mm.

S. India, Nilgiri Hills (*Hampson*) (Distant coll.); one female, holotype.

Courtesius quinquesignatus, sp. n.

Black, the posterior angles of the pronotum with the adjacent parts of the hind border of the prosternum, an apical spot at the scutellum, and a central oval spot on the hemielytra, whitish yellow. First to third dorsal segments entirely, fourth segment only in the centre yellow. Connexivum black; the whole outer edge yellow. Apical border of the ultimate ventral segment of the male slightly bent outward; the disk of the segment showing two small transverse keels, and more posteriorly a shallow medial impression.

Length of the male 5 mm., of the female $6\frac{1}{2}$ mm.

S. India, Kodai Kanai (*T. V. Campbell*); one male and one female, holo- and allotype.

SIANGO, gen. nov.

Capite basi subtus subconstrieto. Segmento anali marium mediocri. Segmento sexto (septimo) ventrali feminarum oblique truncato, leviter producto. Bucculis modice elevatis, rotundato-subangulatis. Impressione aream antioam thoracis includente obsoletissima, thoracis marginibus

lateralibus haud reflexis. Rostrum pone coxas intermedias paullo extenso, articulo primo basin capitis superante, articulis duabis ultimus simul sumptus longiore. Margine apicali corii rotundata, membrana abbreviata. Alæ rudimentariæ.

The affinities of this very strange insect are not quite clear to me, as it has some points of agreement with several other genera of Pyrrhocorinae. In general aspect, however, it agrees more or less with *Pyrrhocoris*, the structure of the rostrum being also similar, but, on the other hand, because of the structure of the head and of the ultimate ventral segment of the female, the species shows some affinities to the genus *Antilochus*.

Siango variegata, sp. n. (Fig. 1.)

Head slightly broader than the anterior margin of the pronotum. Pronotum trapezoidal, as long as the width across the posterior margin; the sides distinctly concave behind the middle. Head black, shining. Pronotum dull black, the posterior and anterior borders rather broadly yellow. Underside of the thorax shining black, the anterior and the posterior borders of the first segment, the posterior border of the third segment, and spots on the acetabula yellow, finely and sparingly punctured with brown. Scutellum and clavus dull black; corium yellow, an irregular stripe along the base of the clavus, a large spot at the centre, and a rather broad border along the apical margin dull black. Membrane narrow, black. Abdomen bright red, first segment for the greater part and second segment laterally black. Antennæ, rostrum, and legs black, shining. Anterior tibiæ more or less brownish.

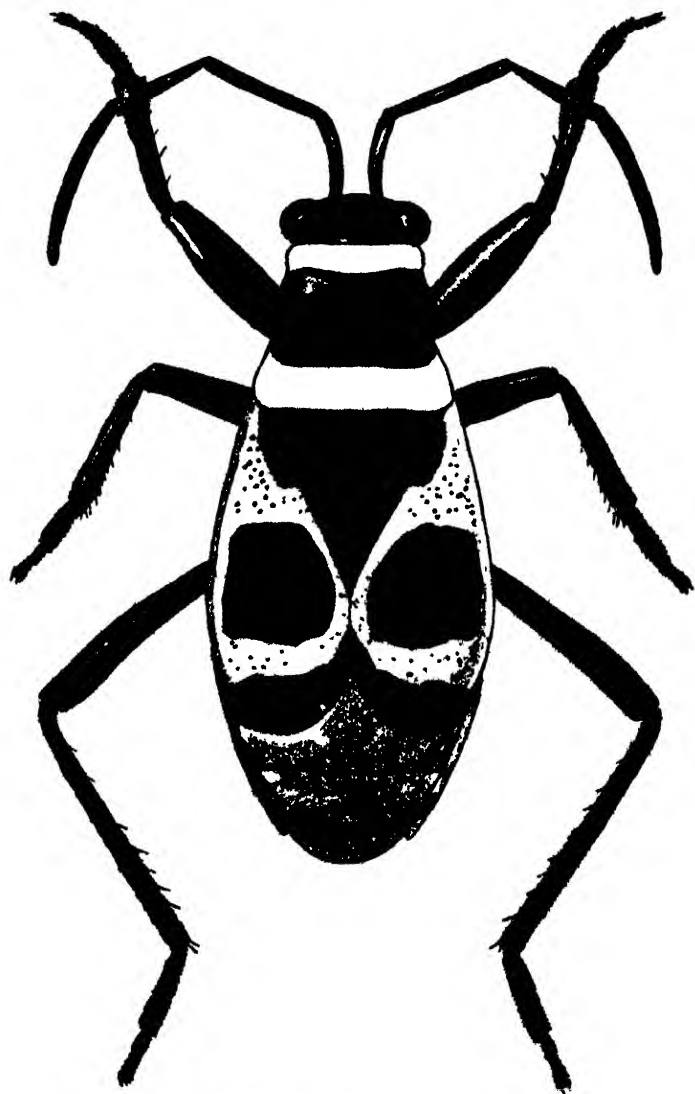
Length of the male 8½ mm., of the female 10–10½ mm.

Uganda, Kampala, 28th Feb., 1926 (*W. S. Martin*), on *Hibiscus rosa-sinensis* (cultivated); male and female in copula, holo- and allotype. Kenya, Wanga, July 1921; one female, paratype; these three specimens from the Imperial Institute of Entomology. Uganda, Entebbe, Feb. 1912 (*Dr. C. A. Wiggins*); one female, paratype.

Scantius aegyptius L. subsp. *iraquensis*, nov.

This form is closely allied to the typical form of *Scantius aegyptius*, and it will depend upon the results of later investigations on the geographical distribution

Fig. 1.

*Siango variegata*, gen. et sp. n.

of both forms and on the presence or absence of intermediates whether this form is to be regarded as a geographical subspecies of *S. aegyptius* L. or as a distinct species. For the moment I think it better to keep these forms together.

The ground-colour is yellowish ochraceous instead of red, as it is in the typical *S. aegyptius* L. The black markings are quite similar to those of *S. aegyptius* L., but their colour is somewhat more brownish; the legs too, are of a paler colour, the tibiae being yellowish grey.

Over and above these differences in colour there is a slight difference in the structure of the ultimate ventral segment of the male. The apical edge shows in both forms a semicircular extension that is rather variable in dimension; but in the subsp. *iraquensis* it is smaller than in the forma typica, occupying less than one-third of the space between the posterior angles of the sixth tergite.

Iraq, Hinaida, May 1922 (*Major J. E. M. Boyd*). A large series, holo-, allo-, and paratypes.

Delacampius rhodesianus Dist. = *Scantius circumcinctus* Leth.

Having examined a number of specimens belonging to the genus *Scantius*, I am convinced that *Delacampius rhodesianus* Dist. must be the same as *Scantius circumcinctus* Leth. On the other hand, *Scantius volucris* of Distant is not *S. volucris* of Gerstaecker, but probably more closely related to *S. caraboides* Bergr. As I have been unable to compare the types of both species with one another I am not sure if they are identical or not, but it seems probable that the Indian form will prove to be different from the African one.

Dysdercus mimuloides, sp. n.

Ultimate joint of the antennæ without a white annulation. Head reddish. Pronotum red, the anterior area with indefinite black markings; the centre of the posterior portion blackish; the anterior and posterior borders whitish. Scutellum black. Hemelytra black, with a

Ann. & Mag. Nat. Hist. Ser. 10. Vol. xi. 41

narrow yellow costal stripe and a narrow white border to the membrane. Underside red, with white borders at the posterior edges of the segments. Anterior border of prosternum and coxal cavities whitish. Legs blackish.

This species is not unlike *D. mimulus* Hussey, but is larger and more shining; besides, there is a difference in the structure of the ultimate ventral segment of the male, that shows a deep triangular impression that is even larger and more angular than in *D. mimus* Say. The edge of it is slightly protruded into a rounded lamella at the centre of the impression.

Length of the male $12\frac{1}{2}$ mm., of the female 13 mm.

Gulf of Panama, Perlas Island, Isla del Rey (*L. E. Cheesman*); one male and one female, holo- and allotype.

Dysdercus mimus Say aberr. *quadrisignatus*, nov.

This form is quite similar to the typical form of *D. mimus* Say, but instead of the single semicircular spot against the edge of the hemielytra it shows two small black spots on each hemielytron, side by side on the corium, slightly behind the apex of the clavus, and both free from the edges. Scutellum and posterior border to pronotum black

Nicaragua, Chontales (*Janson*); one male, holotype of the aberration.

Dysdercus clavatus, sp. n.

This species is allied to *D. incertus* Dist., and agrees with this species in the peculiar structure of the anterior area of the pronotum. It is easily recognizable from it by the black clavus. Head and anterior area of the pronotum red. Antennæ without a white basal annulation to the fourth joint. Anterior border of the pronotum white, posterior part almost entirely black, with only a narrow red border. Scutellum and clavus black; basal half of the corium yellow, apical half black. Membrane black, with a narrow white border. Underside yellow, with reddish spots at the sides of the thoracic segments, red bases to the ventral segments, and red spots to the sides of the fifth and sixth ventral segments. Femora reddish; tibiae and tarsi blackish. Ultimate ventral segment of the male with a rather broad somewhat

triangular impression. Apical edge at each side of the impression with a small but distinct protuberant extension, the central part of the edge between these extensions being situated slightly lower than the lateral portions of it.

Length of the male $10\frac{1}{2}$ mm.

Panama, V. de Chiriqui, 2000–3000 feet (*Champion*); one male, holotype.

Dysdercus affinis, sp. n. (Fig. 2.)

Similar to *Dysdercus ruficollis* L. and *Dysdercus immarginatus* Blöte, differing from both species in having a longer pronotum, with nearly straight lateral edges. Head red; scutellum yellow; membrane with a narrow greyish-white border.

Fig. 2.



Ultimate ventral segment of the male of *Dysdercus affinis*, sp. n.

The ultimate ventral segment of the male shows a narrow, triangular, somewhat gutter-shaped impression at the centre, extending on to a more or less angular lamella, which shows a distinct corner at both sides, and two very blunt ones near the centre. The segment is not unlike that of *D. immarginatus* Blöte, but the impression in this species is broader, its cavity nearly spheroidal, whilst in *D. affinis* it is distinctly elongated and narrowed at the lower end.

Length of the male $12\frac{1}{2}$ – $13\frac{1}{2}$ mm., of the female 15 mm.

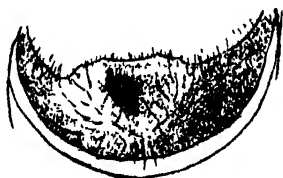
Lower Amazon, Parintins, 4th Feb., 1896 (*E. E. Austen*); two males, holo- and paratype, and one female, allotype.

Dysdercus austeni, sp. n. (Fig. 3.)

Similar in general aspect to *D. fulvioniger* de Geer, but the costal edges of the hemelytra are not brownish and

the femora are entirely red without a black apex. Ultimate joint of the antennæ with a basal white annulation. Head, anterior area, and lateral borders of the pronotum red; anterior border of the pronotum whitish, posterior part ochraceous, with a narrow greyish-brown stripe near to the posterior edge. Scutellum and hemielytra ochraceous, the corium slightly brownish at the apical edge. Membrane obscure greyish brown, with a narrow

Fig. 3.



Ultimate ventral segment of the male of
Dysdercus austeni, sp. n.

white border. Ultimate ventral segment of the male with a rather large, sphaeroidal, only slightly triangular impression; the edge of it not elevated. At the apical edge of the segment the impression is terminated by a short lamella that is bent outward rather distinctly; the edge of this lamella shows some small incisurations and teeth.

Length of the male 12 mm., of the female 14–15 mm.

Lower Amazons, Parintins, 4th Feb., 1896 (*E. E. Austen*); one male, holotype, and one female, allotype. Amazons, Madeira River (*Distant coll.*); one female, paratype.

LXIII.—*A new Sphingonotus from Morocco (Orthoptera, Acrididæ).* By B. P. UVAROV.

Sphingonotus nadigi, sp. n.

Similar to *Sph. callosus* Fieber, but differing from it in the median pronotal carina being obsolete in the whole of the prozona.

♀.—Antennæ somewhat longer than head and pronotum together.

Head in profile raised above the pronotum; face oblique. Frontal ridge practically straight in profile; viewed from the front it is generally broad, widened from the fastigium to the ocellum, constricted below the ocellum, almost parallel-sided in the rest, obsolescent near the clypeus; surface of the ridge concave, very uneven; margins raised. Face uneven. Fastigium of vertex sloping, its surface strongly concave, with a well-raised short median ridge which begins from the apex and bifurcates behind, separating three deep pits, two in front and one behind them and between the eyes; temporal foveolæ on strongly sloping plane, weakly concave, short, irregular. Occiput rugulose, especially near the eyes.

Pronotum short and broad, strongly rugose. Median carina entirely absent from the prozona, well raised and acute in the metazona. Front margin of the prozona is raised against the occiput like a collar, and is followed by a deep and fairly broad submarginal sulcus. Transverse sulci deep; the interspace between the second and third sulcus with a pair of low tubercles. Metazona somewhat longer than prozona, with numerous acute wrinkles; posterior angle obtuse, its margins scarcely wavy; shoulders somewhat prominent, but there are no regular lateral keels either in metazona or in prozona. Lateral lobes considerably higher than long; anterior margin S-shaped, slightly wavy; anterior angle about 90° ; lower margin strongly ascending, sinuate in the anterior quarter; posterior angle a little less than 90° , not rounded.

Elytra almost reaching the apex of hind tibiæ. Venation not very regular. False vein in the discoidal field nearer to the radial and approaching it still more towards the apex; the area behind it with about three rows of irregular cells.

Hind femur with the upper carina slightly wavy and lowered in the apical quarter.

Coloration reddish brown. Elytra in the basal quarter reddish brown, paler in the rest, with a faint postmedian fascia and a few spots in the apical third along the radial vein and the posterior margin. Wings pale bluish, with a black fascia which does not reach the hind margin

and disappears immediately on turning inwards. Hind femora on the inner side brownish in the two basal thirds and with a brown preapical spot. Hind tibiae bluish.

Length of body 22; pronotum 4.5; elytra 24; hind femur 11 mm.

Described from a single female taken by Dr. Ad. Nadig at Agadir, Morocco, 11-13. vii. 1931. The type has been kindly presented by the collector to the British Museum (Natural History).

This remarkable new species resembles in its general appearance not only *Sphingonotus callosus*, but also species of the genus *Fortunata* Krauss, but is at once distinguished from all of them by the obsolete median carina of the prozona of pronotum; similar structure of the prozona can be found only in some species of *Sphingonotus* with a smooth pronotum, while in *S. nadigi* it is even more strongly wrinkled than in *S. callosus*.

LXIV.—*Description of a new Characid Fish of the Genus Stethaprion from the Lower Amazon.* By GEORGE S. MYERS, Stanford University, California.

Stethaprion innesi.

Similar in form and appearance to *S. erythrops*, but less deep and caudal peduncle more slender. Depth 1.63 in standard length, head 3.5, length of anal base 2. Eye 2.33 in head, snout 4. Interorbital equal to eye. Dorsal 12. Anal 40, not counting several spine-like scutes at origin. First three branched anal rays forming a conspicuous lobe, the fin-margin posteriorly straight until it rounds off convexly near its end. Scales finely crenate on margins, 62 in lateral line to end of hypural; transverse 18-1-18 to pelvic origin. Predorsal spine formed as in *erythrops*. Gill-rakers 10+13. Occipital process extending more than one-third distance from its base to dorsal. Predorsal line scaled, but without a regular series. Preventral edge with a series of bony scute- or scale-like processes, with rounded ends, arranged as follows:—One scute on each side, the bases of the two overlapping at the mid-line, these followed by a single median scute, then two, then one, and so on.

The scutes thus form a braided pattern down the pre-ventral line, bordered on each side by a row of truncated scales. Postventral edge with a median series of bony compressed scutes projecting backward, which run up to the anal like blunt fin-spines. The first postventral scute is long, double-ended, pointed both before and behind. Coloration plain silvery, adipose fin with a dark border.

A single specimen, 49 mm. in standard length, from the Lower Amazon, Stanford University Fish Collection, No. 25228.

The specimen described was included in a lot of aquarium fishes sent to the writer for determination by Mr. William T. Innes of Philadelphia, for whom the species is named. It differs from *Stethaprion erythrope* Cope and *S. chryseum* Cope, and agrees with *S. crenatum* Eigenmann (see Eigenmann and Myers, Mem. Mus. Comp. Zool. xliii. part 5, 1929, pp. 500-503, for a revision of the genus) in the crenate scales and in the presence of bony scute-like ventral processes. It differs markedly from *crenatum* in the arrangement of these ventral processes, in the lobed anal, and in details of fin and scale formulæ. I am greatly indebted to Dr. Thomas Barbour of the Museum of Comparative Zoology, Harvard University, for comparative material of *S. erythrope*.

A photograph of *S. innesi* has appeared in 'The Aquarium,' Philadelphia, vol. i. no. 6, Oct. 1932, p. 149.

LXV.—*New Argentine Hispinæ.*

By S. MAULIK.

THE two specimens from which the following descriptions are drawn up were sent to me by Dr. Carlos Bruch, of Olivos, Argentina, to whom I am greatly indebted, and in recognition of whose services to entomology I have taken the liberty of naming a species after him. I wish to record my thanks to Miss Grace Lowes for her kind assistance. The illustration is by Miss O. F. Tassart.

NONISPA, gen. nov.

The species on which this genus is based is fully described below. It belongs to the group Uroplatini, in which the genera are characterized by the reduction in the number of segments of the antenna from the normal eleven to eight, seven, six, or three. In the present case there are altogether nine segments, the ninth, tenth, and eleventh having fused into an apical club.

Body oblong, slightly narrowed in front, and attaining its greatest width towards the apex. Head and pronotum smooth; eyes small, not convex; mouth-parts placed in a small circular cavity, the upper border of which is far from the roots of antennæ; elytra parallel-sided; upper surface smooth—that is, without any elevations, depressions, or roughness; each elytron with three flattened ribs raised towards the apex and eight longitudinal rows of punctures; a scutellar row absent; apex of each elytron rounded, so that there is a small emargination at the apical sutural angle; lateral margins of elytra smooth, without serrations or spinules. *Under-side* smooth; legs slender.

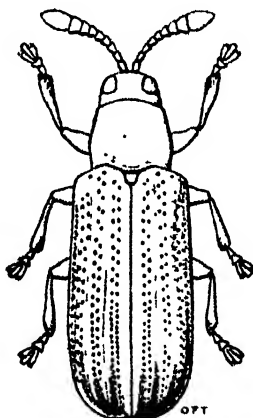
This genus is related to *Microrhopala* Baly, but differs from it in not being ovate.

Nonispa carlosbruchi, sp. n.

Colour of upper surface greenish and of underside black.

Head narrowed in front, with the collar impunctate, the interocular area smooth, flat, finely shagreened, and with one or two punctures. Antenna short, extending to about the base of the elytra; the first two segments small, rounded, and equal; third longer; fourth, fifth, and sixth about equal to each other, but each is shorter than the third; seventh larger, wider at the apex than at the base; eighth similar to seventh, but much larger; the ninth is a large elongate club narrowed towards the apex, the fusion of the three apical segments being complete; the articulation of the eighth to the ninth is distinct, but not so pronounced as, for example, that of the seventh to the eighth. On the outer side of the eighth and the ninth certain distinct areas, one on the former and three on the latter, are recognizable. The

hair-covering on the antennæ, if any, is very fine and hardly visible. These notes are taken from a specimen especially prepared as a microscopic slide. *Prothorax* almost as long as broad, widest across the middle, more narrowed in front than posteriorly; sides finely margined; anterior and posterior corners rounded; upper surface convex, slightly sloping on each side, more so in front, finely shagreened, impunctate except for a few punctures; slightly depressed at base in front of the scutellum. *Scutellum* almost square, apex rounded, with a slight depression in front of it, surface finely shagreened. *Elytra* slightly broader at the base than the prothorax,



Nonispa carlosbruchi, gen. et sp. n.

shoulders raised, rounded and impunctate; suture flattened. The punctures are well impressed, but not sufficiently large as to occupy the whole space between two ribs—that is to say, there is a well-developed interstice between the punctures. This characteristic is not very often seen in beetles of the group under consideration. Between the suture and the first rib there are two rows, between the first and second two, between the second and third two, and, finally, between the third and the lateral margin two rows. The disposition of the punctures in each series, although more regular towards the apex, on the basal area tend to be placed alternatively

and also to become sparser. On the apical area the suture and the ribs are distinctly raised, the surface is somewhat rough, and the margin is slightly more explanate. *Underside* smooth, impunctate, and without hairs. The epipleuron is of the same width throughout. The abdominal sternites are somewhat sunk in the elytral cavity. Tibiæ slender; each tarsus with the first segment smaller than the next, which is again smaller than the deeply bilobed segment, the claw-segment very slightly projecting beyond, claws well developed.

Length 3.75 mm.

Greatest breadth 1.5 mm.

ARGENTINA: Chana, Delta Arroyo, 2. iii. 1919 (*E. Blanchard*).

Described from one example.

Type in the British Museum.

Stenispa rosariana, sp. n.

Body elongate, parallel-sided, attaining its greatest breadth behind the middle; not narrowed towards the apex—that is, almost as broad across the apex as across the base.

Head slightly narrower than the front margin of the prothorax; interocular area somewhat concave, shagreened, and covered with shallow coarse punctures which are not very close to each other; interantennal area excavated and with a median longitudinal ridge. Eyes fairly large, not very convex. Antenna somewhat thickened in the middle, with the first segment shorter than the second, the third the longest segment, segments 4 to 10 about equal to each other, the last segment somewhat longer and laterally flattened at the apex. The surface of the whole antenna is covered with short and stout hairs. *Prothorax* almost as long as broad, very slightly narrowed towards the base; the basal margin bisinuate, having the middle portion produced towards the scutellum; the sides straight and the margins channelled, the channels widening at the anterior lateral angles, which are produced in front; posterior lateral corners almost right angles; upper side convex longitudinally along the middle, gradually sloping down on each side, the front portion very slightly drawn forward, the margin being curved accordingly; the background of the surface

shagreened, covered with punctures, sparsely in the middle area and gradually getting closer towards the lateral margins, a narrow longitudinal area along the middle and a large area in front being free of punctures; the punctures fairly large and well impressed. *Scutellum* pentagonal, with the surface very finely shagreened. *Elytra* almost as broad at base as that of the prothorax, rounded at the anterior corners; lateral margins parallel; each side with a certain long sweep of concavity commencing behind the shoulders to a point behind the middle; shoulders raised, smooth and impunctate; the background of the surface finely shagreened; the basal area between the shoulders and a certain area on each side of the suture up to the point where the surface bends down towards the apex flat; punctate-striate, the punctures fairly large and well impressed; a certain portion of the flat basal area free of punctures; a short scutellar row of punctures present on each elytron and, in addition, ten rows; on the apical area the rows have become confused; the interstices appear to be more raised towards the apex; seen from the underside the edge of the apical margin very finely serrulate. *Underside*: the background of the surface finely shagreened; sparsely covered with fine hairs; a large middle area of the metasternum and a triangular area on the apical margin of each abdominal sternite free of hairs and punctures; last visible sternite gently emarginate in the middle; epipleuron of the same width throughout; legs short, stout, femora thickened in the middle, tibiae short, tarsi large, almost as long as the tibiae, claws divaricate.

Length 5.5 mm.

Greatest breadth slightly less than 2 mm.

Length of antenna about 2 mm.

ARGENTINA: Rosario, Stevenin (Dr. Carlos Bruch).

Described from one example.

Type in the British Museum.

Relationship.—The present species resembles *Stenispa parallela* Pic in the parallel-sidedness and in the fact that the apex of the elytra is not narrowed as it is in most of the species of the genus, but differs in being broader, in having the prothorax of a different structure (that is, not narrowed towards the base as in *parallela*), and in having the elytral punctures larger.

LXVI.—*A new Species of Avian Cestode from India.*

By N. B. INAMDAR, B.Sc., Zoology Department,
College of Science, Nagpur, C.P., India.

I OBTAINED six specimens of a cestode belonging to the genus *Malika* Woodland, 1929, from the intestine of an Indian Pitta (*Pitta brachyura* (Linn.) Gould). The genus was created by Woodland (1929) to include a cestode obtained by him from a stone-curlew (*Edicnemus scolopax*), from the United Provinces, India. So far, the genus contains only one species, *Malika edicnemus* Woodland, 1929. The species described in this paper is another from the same zoogeographical region.

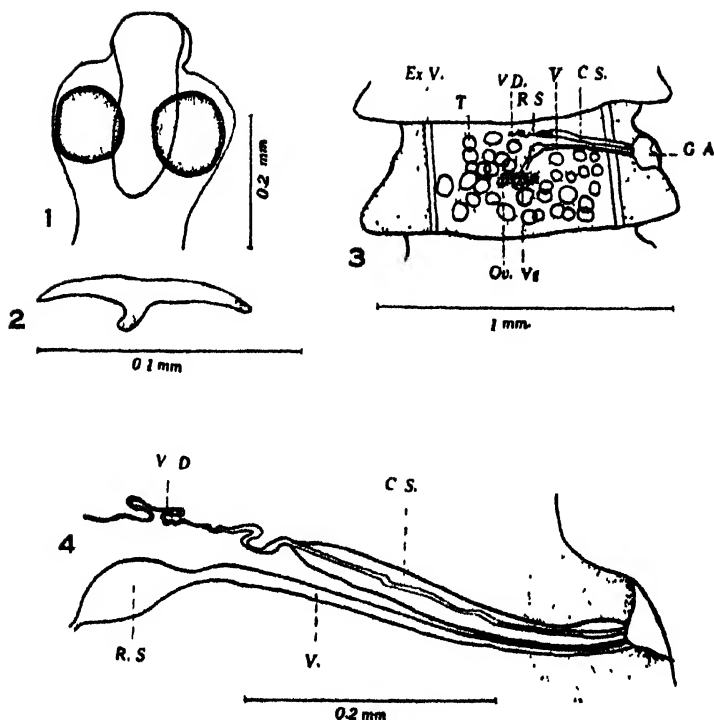
Malika pitta, sp. n.

Anatomy.—The maximum length of the worm is 50 mm. and the maximum width is 1.9 mm. All the segments are broader than long. Mature proglottids measure 0.44 mm. in length and 1.5 mm. in maximum width, and gravid proglottids measure 0.64 mm. in length and 1.9 mm. in maximum width.

The scolex (fig. 1) is 0.28 mm. in diameter. The rostellum is 0.28 mm. in length. It bears a single circle of twenty-four hooks, each measuring about 80μ in length. The shape of the hook is as shown in fig. 2. The suckers are nearly globular, and each measures 114μ in diameter. The genital pores are unilateral, and are situated in the middle of the lateral margin of the proglottid.

The testes (fig. 3, *T.*) are 35 to 40 in number, and each measures 64μ in diameter. They surround the ovary, and in this respect their arrangement varies from that in *Malika edicnemus* Woodland, 1929. The vas deferens (figs. 3 & 4, *V.D.*) is convoluted. The cirrus-sac (*C.S.*) is elongated, and has a uniform diameter. It measures 0.273 mm. in length and contains a nearly straight cirrus. The cirrus-sac opens into a genital atrium (*G.A.*), which is well developed.

The ovary (fig. 3, *Ov.*) is slightly paral. The vitelline gland (*Vg.*) is situated slightly lateral to the ovary. The vagina is a narrow canal, but it enlarges into a globular



Malika pitta, sp. n.

Fig. 1.—Scolex.

Fig. 2.—A rostellar hook.

Fig. 3.—A mature proglottid.

Fig. 4.—Cirrus-sac, vagina, and the genital atrium.

Abbreviations used on figures.

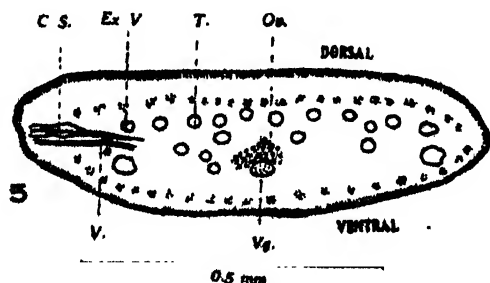
C.S. Cirrus-sac.
Ex. V. Excretory vessel.
G.A. Genital atrium.
Ov. Ovary.
R.S. Receptaculum seminis.

T. Testes.
V. Vagina.
V.D. Vas deferens.
Vg. Vitelline gland.

receptaculum seminis (figs. 3 & 4, *R.S.*) as it nears the ovary. The vagina opens into the genital atrium posteriorly to the cirrus-sac. Both the genital ducts pass between the excretory vessels and dorsal to the nerve.

The uterus in gravid segments fills nearly the entire proglottid between the excretory vessels. It breaks up into capsules, each containing eight to twelve eggs. Eggs (in balsam) measure $49\ \mu$ by $44\ \mu$ and the contained embryo $40\ \mu$ by $32\ \mu$. The cirrus-sac persists in gravid segments.

Discussion.—This worm belongs to the subfamily Dipylidiinae in virtue of its uterus breaking up into egg-capsules. The only genera in this subfamily which have



Malika pitae, sp. n.

Transverse section of a mature proglottid.

an armed rostellum and unilateral genital pores are *Similuncinus* Johnston, 1909, *Southwellia* Moghe, 1925, *Allurotaenia* Cameron, 1928, and *Malika* Woodland, 1929. The genus *Allurotaenia* Cameron, 1928, is held by Woodland (1929, p. 175) to be synonymous with the genus *Similuncinus*. Johnston, 1909. In the remaining three genera the genital canals pass respectively ventrally to, dorsally to, and between the excretory vessels. The worm described in this paper belongs to the genus *Malika* Woodland, 1929, since the genital canals pass between the excretory vessels. The species can be distinguished from *Malika adicnemus* Woodland, 1929, by the size of the suckers, rostellum, and rostellar hooks,

and by the arrangement of the testes. I consider it, therefore, to be a new species, for which I propose the name *Malika pittæ* with the following specific diagnosis:—

Length 50 mm., maximum width 1.9 mm.; diameter of scolex 0.28 mm., rostellum 0.28 mm. in length, armed with a single crown of twenty-four hooks, each 80μ in length; suckers 114μ in diameter; testes 35 to 40 in number surrounding the ovary, each 64μ in diameter; receptaculum seminis present; eggs (in balsam) 49μ by 44μ and the embryo 40μ by 32μ .

Host: *Pitta brachyura* (Linn.) Gould.

Habitat.—Intestine.

Locality.—Nagpur, C.P., India.

REFERENCES.

1924. MEGGITT, F. J. 'The Cestodes of Mammals.' London.
 1929. WOODLAND, W. N. F. "On some new Avian Cestodes from India." 'Parasitology,' vol. xxi. pp. 168-179.

BIBLIOGRAPHICAL NOTICE.

What Butterfly is That? By G. A. WATERHOUSE. Green cloth, $8\frac{1}{2} \times 6\frac{1}{2} \times 1\frac{1}{2}$: 291 pages, 25 coloured plates of butterflies by N. W. Cayley, 9 uncoloured plates of early stages by Miss P. Clarke, 4 text-figures. Published by Angus and Robertson, Sydney, and obtainable in England from the Australian Book Company, 16 Farringdon Avenue, E.C. 4. Price 12s. 6d. in Australia or England.

In the Preface it is stated that the objects of the work are to enable the butterflies of Australia to be readily identified and to encourage the discovery of details at present unknown. In the Introduction (pp. 1-23) the author describes in simple language: the position of the Butterfly in Nature; Structure; Classification; Variation and Distribution. For each sub-family there is an introductory chapter, followed by a chapter for each plate, wherein for each species and subspecies following the plate numbering is given:

- (a) The trivial name.
- (b) The Latin name, author's name, and date of publication.
- (c) A number in brackets giving the sequence of arrangement in a collection.

- (d) The distribution.
- (e) Short description of the butterfly.
- (f) Short description of the early stages and name of food-plant, where known.
- (g) A note on habits etc.

The book closes with a chapter on collecting, setting, and preserving, followed by an index to the Latin and trivial names. On the attractive white paper wrapper there is depicted a life-size coloured figure of *Papilio priamus* seated inside a scarlet note of interrogation.

This is a most fascinating book, and fulfils very completely the purpose for which it is intended. The brilliant wrapper and the title appear to strike a frivolous note, but the subject-matter is accurate and up-to-date, so that a high scientific standard has been attained, enabling the book to be used for the arrangement of any museum collection. Doctor Waterhouse, the author, is the leading expert on Australian butterflies, having established himself in that position by the publication, in collaboration with G. Lyell, of 'The Butterflies of Australia' in 1914: he has spared no pains in preparing the present volume, which contains much additional information and is not burdened with any technical terms, long descriptions, or lists of references and synonyms. Mr. Neville Cayley has already made a name for himself in Australia with his books on birds, containing most beautifully executed coloured figures. His figures of butterflies are beyond all praise: with the smallest insect the detail is so accurate that identification is assured. Every species is figured, also both sexes when they differ materially, as well as the more remarkable subspecies and varieties. In the case of the larger butterflies the figures have been reduced to half life-size, but the detail is perfect. The Introduction contains all that an amateur need know, while further knowledge can always be readily obtained from more general text-books, such as Dr. R. J. Tillyard's wonderful work on 'The Insects of Australia and New Zealand.' The only obvious criticism is the necessity for the collection numbers in brackets after the Latin name; it would have been preferable to have arranged the sequence in the plates and the text in the collection order.

The publishers, Messrs. Angus and Robertson, are to be congratulated upon the production of a book with so many plates at such a reasonable price. Australia has set a very high standard in this respect, which it is hoped may be followed elsewhere.

W. H. E.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 66. JUNE 1933.

— — ◆ — —

LXVII.—*On a Collection of Nematodes from Malayan Reptiles.* By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

THE following is a report on a collection of parasitic Nematodes from reptiles, obtained in the Federated Malay States by Mr. G. B. Purvis, F.R.C.V.S., and kindly presented by him to the British Museum (Natural History). The collection includes five species which appear to be undescribed and several which were previously recorded only from other localities, chiefly in India.

Family *Ascaridæ*.

Subfamily *ASCARINÆ*.

Larval forms, apparently belonging to this subfamily, were collected from (a) the peritoneum and liver of a snake (*Passerita prasina*) at Raub, Pahang; (b) the stomach (in an ulcer) and (?) intestine of *Zamenis korros* at Port Weld; (c) the intestine of an unnamed snake at Port Weld.

Subfamily *ANISAKINÆ*.

Porrocaecum crocodili Taylor, 1924.

A number of specimens which are referred to this species occurred in the stomach of an unnamed crocodile
Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 42

at Port Weld. *P. crocodili* appears to be a widely distributed species, having already been recorded from West Africa and from Australia.

Family Kathlanidae.

Spironoura siamensis (Baylis, 1920).

Syn. *Falcaustra siamensis* Baylis.

Several specimens collected from the intestine of a water-tortoise (*Heosemys grandis*) at Alor Star are referred to this species, which was originally recorded from *Hieremys annandalei* in Siam.

Spironoura stewarti (Baylis & Daubney, 1922).

Syn. *Falcaustra stewarti* Baylis & Daubney.

A number of specimens collected from the intestine of *Heosemys grandis* at Kedah are referred to this species. Two females also occurred, together with *S. siamensis*, in a tortoise of the same species at Alor Star.

S. stewarti was originally recorded from *Kachuga smithii* and *Hardella thurgi* in India. It appears to be a somewhat variable species, but the differences noted in the measurements of specimens from the two original hosts were not considered great enough to warrant the erection of two species. The present Malayan specimens approach more nearly in their measurements to the examples from *Hardella* than to those from *Kachuga*.

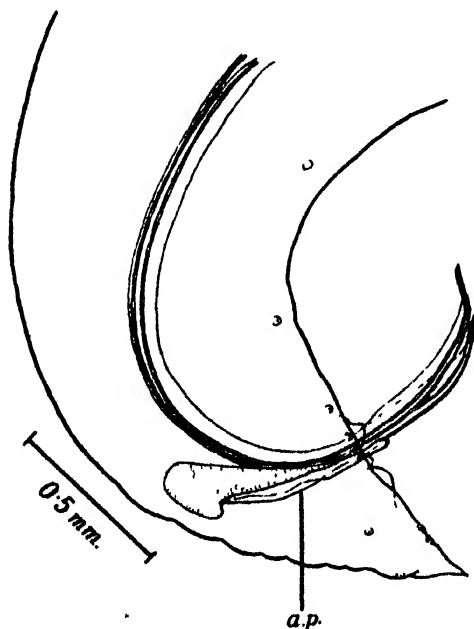
Zanclophorus purvisi, sp. n. (Fig. 1.)

The collection contains four males and one female of a species of *Zanclophorus* which is considered to be new. These were obtained from the large intestine of the tortoise *Heosemys grandis* at Kedah.

The males measure 21-24 mm. in length and about 1.4-1.7 mm. in maximum thickness, the female about 25 mm. and 1.75 mm. respectively. The cuticle has very fine transverse striations. The head, as in the genotype, is narrower than the neck. Its diameter is 0.22-0.24 mm. The structure of the head is similar to that in the genotype. The total length of the oesophagus, measured from the anterior extremity, is 2.5-2.8 mm. The pharynx measures 0.125-0.15 mm. in length, and the posterior bulb, including the smaller anterior and

the larger posterior swelling, 0.5–0.63 mm. The width of the posterior swelling is 0.47–0.53 mm. The nerve-ring is situated at 0.5–0.55 mm. and the small cervical papillæ at 1.7–2 mm. from the anterior extremity. The excretory pore was not found. Some irregularly scattered pigment is present round the œsophagus in the neighbourhood of the nerve-ring.

Fig. 1.



Zanclophorus purvisi, sp. n. Posterior end of male; lateral view.
a.p., accessory piece.

The tail in both sexes has a small, conical, terminal spike. The tail of the male is rapidly tapering and measures 0.45–0.5 mm. in length. There is a single muscular preanal sucker, situated at a distance of 0.6–1.15 mm. from the cloacal aperture. There are four pairs of postanal papillæ (two subventral, one subdorsal, one lateral) and six pairs of adanal and preanal papillæ, arranged as in the genotype—i. e., three pairs

close together near the cloacal aperture and three pairs situated at considerable intervals between these and the sucker. No median precloacal papilla was seen. The spicules measure 2.4–3.6 mm. in length, and are alate and finely striated. Their maximum dorso-ventral width, including the alæ, is about 0.07–0.08 mm. The accessory piece is of peculiar shape, having a large, proximal, unchitinized portion with a solid expanded head and a narrow, protrusible, chitinized distal portion. The two portions are applied to each other for a considerable part of their length. The total length of the organ is 0.63–0.71 mm.

The tail of the only female available is much retracted. It appears to be very blunt except for the small terminal spike, and to be about 0.3 mm. long.

The vulva is situated at about 9 mm. from the posterior end. The vagina runs forward from it and is 2.8 mm. long. Its width for the greater part of its length is only about 0.1 mm., but it widens to nearly 0.2 mm. just before opening into the uterus. The anterior uterine branch extends to a point about 1.5 mm. behind the junction of the œsophagus and intestine, the posterior to within 1.2 mm. of the hinder end of the body. The eggs are oval and measure 0.0725–0.095 mm. \times 0.055–0.06 mm. They contain coiled embryos *in utero*.

This is a larger and stouter form than *Z. annandalei* and *Z. kempi*, both of which were described by Baylis and Daubney from species of *Testudo* in India. It closely resembles the former species in many respects, but the accessory piece of the male is of quite a different shape. *Z. cryptobranchi* Walton, 1930, from *Cryptobranchus alleganiensis* in North America, is a still smaller species, and the spicules of the male measure only 0.75 mm. in length. The writer has unfortunately been unable to consult the description of *Z. ararath* Massino, 1924, from *Emys orbicularis*.

Family Atractidae.

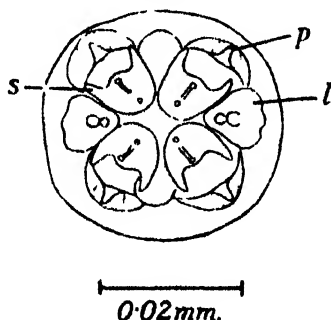
Monhysterides testudinicola, sp. n. (Figs. 2–5.)

This species occurred in immense numbers in the large intestine of a freshwater tortoise, *Trionyx cartilagineus*, at Raub, Pahang.

The male measures 2.75–2.95 mm. in length and 0.12–0.15 mm. in maximum thickness, the female 2.95–3.55 mm. and 0.17–0.25 mm. respectively. The posterior half of the body proper (excluding the tail), to which the genital organs are confined, is considerably stouter than the anterior half, particularly in the female. In the male the posterior half of the body frequently forms a single coil. The transverse cuticular striations are very faint, and the interval between them is about 3μ . Lateral alæ are present in the posterior half of the body only, and extend posteriorly to about the level of the anus. In the female they attain a maximum width of about 0.03 mm.

The mouth is surrounded by six small lips, which have the form shown in fig. 2. Two of the lips are simple

Fig. 2.



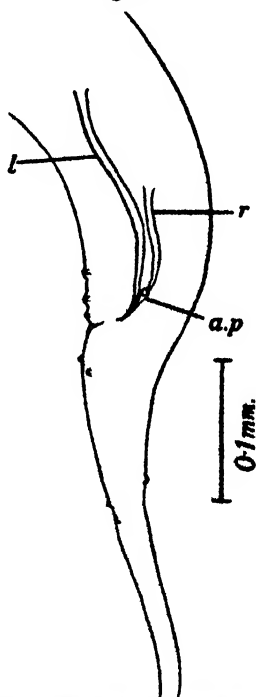
Monhysterides testudinicola, sp. n. Anterior extremity of female, viewed on face.

l, lateral lip; *p*, submedian papilla; *s*, submedian lip.

in structure and lateral in position. Each of these bears at its apex a rather large papilla with double terminations. The other four lips are submedian (two subdorsal and two subventral). Each of these is of rather complex structure, having a somewhat crescentic apical portion with two outwardly projecting horns. At the base of the lip there is a relatively large papilla with a simple pulp, while at the apex there appear to be two very small papillæ, whose innervations possibly arise from a common stem.

The total length of the oesophagus in well extended specimens is 0.45–0.5 mm. It has a relatively short, cylindrical, muscular, anterior portion measuring 0.17–0.18 mm. in length. The histological appearance of the walls of this portion is slightly modified for a short distance at the anterior and posterior extremities, but it does not possess a posterior bulb. The posterior portion

Fig. 3.



Monhysterides testudinicola, sp. n. Posterior portion of male (extremity of tail omitted); lateral view.

a.p., accessory piece; l, left spicule; r, right spicule.

of the oesophagus is longer and more granular in appearance, and expands at its hinder end into a bulb with a transverse diameter of 0.055–0.065 mm. The whole of this posterior portion probably represents a bulb with a long "neck." This neck is surrounded by the nerve-ring at

a distance of about 0.23 mm. from the anterior extremity of the worm. In front of this point, but a little behind the junction of the two portions of the oesophagus, there is a pair of inconspicuous cervical papillæ. The excretory pore is large and conspicuous, and is surrounded by radial markings. It is situated at 0.36–0.4 mm. from the anterior extremity.

The tail in both sexes is produced into a very long, tapering, and finely pointed filament. In the male the

Fig 4

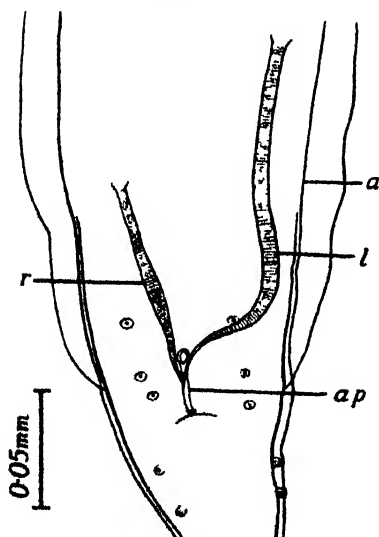


Fig 5



Monhyeterides testudinicola, sp. n.

Fig. 4.—Cloacal region of male; ventral view. *a*, lateral ala; *a.p.*, accessory piece; *l*, left spicule; *r*, right spicule.

Fig. 5.—Accessory piece; lateral view.

tail measures 0.8–0.9 mm. in length. There are eight pairs of caudal papillæ (figs. 3 & 4), which are small and often difficult to see. Five pairs are postanal and three pairs preanal. The latter are all close to the cloacal aperture, and subventral in position. Of the postanal papillæ four pairs are subventral, two being situated close behind the cloacal aperture and two considerably further back. Near the latter there is a pair of subdorsal

papillæ. The spicules are very unequal in length, the left measuring about 0.165 mm. and the right 0.09 mm. Both are tubular, tapering and finely transversely striated. There is a small accessory piece, of the form shown in figs. 3, 4 and 5, with an expanded proximal end and a bent distal end. It measures about 0.04 mm. in length. There is a single reflexed testis.

The tail of the female is 1.05–1.3 mm. long. The vulva is situated at a distance of about 0.05 mm. in front of the anus. The single uterus is wide and thin-walled, and is connected at its anterior end by a sphincter and a narrow oviduct with a single reflexed ovary. In mature females the uterus contains from fifteen to twenty well-developed embryos. These do not appear to be enclosed in membranes, and measure about 0.8–0.9 mm. in length and 0.033 mm. in thickness. Earlier developmental stages were not observed.

This species closely resembles the genotype, *M. piscicola* Baylis & Daubney, 1922, which was found in a fish (*Barbus tor*) in India. It differs from it, however, in the possession of an accessory piece in the male. This necessitates a slight modification of the generic diagnosis.

Family Diaphanocephalidae.

Kalicephalus radicus Bhalerao, 1931.

A number of specimens which are provisionally referred to this species were obtained from the intestine of a snake, *Elaphe flavolineata*, at Raub. A few further specimens were collected from an unnamed snake, also at Raub. The female worms attain a slightly larger size than those described by Bhalerao, the largest being 11 mm. long. The spicules of the male vary in length from 0.26 to 0.33 mm., the average length being about 0.31 mm., while Bhalerao gives 0.282–0.295 mm. The host of Bhalerao's material was *Naja hannah*, and the locality Muktesar, India. From the measurements given it seems possible that *Kalicephalus longior* Maplestone, 1931, from *Naja tripudians* and *Bungarus fasciatus* in the Zoological Garden, Calcutta, may be identical with *K. radicus*. Maplestone, however, describes only the female. Should the male prove to be identical with that of *K. radicus*, the name

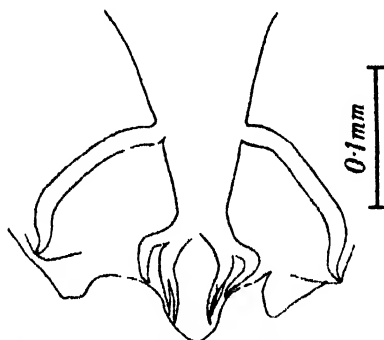
longior would take precedence, having been published in the previous month.

Kalicephalus obesus, sp. n. (Fig. 6.)

This species occurred in small numbers, together with *K. radicus*, in the intestine of *Elaphe flavolineata* at Raub. A single female specimen also occurred, with *K. radicus*, in an unnamed snake at the same locality.

This is a small and relatively unusually stout form. The male measures 4-4.3 mm. in length and 0.33-0.4 mm. in maximum thickness, the female 4.8-5.7 mm. and 0.45-0.48 mm. respectively. The diameter of the head, at the level of the base of the buccal capsule, is 0.24-0.3 mm.

Fig 6



Kalicephalus obesus, sp. n. Dorsal ray of bursa of male; dorsal view.

The transverse cuticular striations are very fine and faint. The anterior end is somewhat oblique, the mouth being tilted a little towards the dorsal side. The buccal capsule measures 0.17-0.2 mm. in total length. The duct of the dorsal oesophageal gland extends for more than half its length. The oesophagus (excluding the buccal capsule) is 0.3-0.33 mm. long, and its bulbous posterior portion has a maximum width of 0.15-0.2 mm. The nerve-ring is situated at 0.26 mm., the excretory pore at 0.34 mm., and the cervical papillae at 0.4 mm. from the anterior extremity.

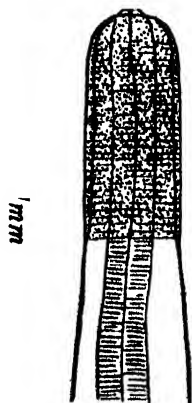
The bursa of the male is comparatively small and bell-shaped. The main stem of the dorsal ray (fig. 6)

is very broad, and its terminal branches relatively long and slender. The spicules measure 0.35–0.39 mm. in length, and the accessory piece about 0.15 mm.

The tail of the female is about 0.15 mm. long and narrows rather suddenly a little behind its middle to form a pointed terminal process. The vulva is prominent and is situated at 0.9–1.2 mm. from the posterior extremity. The posterior branch of the uterus turns forward immediately to run parallel with the anterior branch. The eggs are very thin-shelled and measure about 0.08 mm. \times 0.043 mm.

This species rather closely resembles *K. indicus* Ortlepp, 1923, but is shorter and stouter and has a larger buccal capsule.

Fig. 7.



Oswaldocruzia malayana, sp. n. Anterior end of female.

Family Trichostrongylidae.

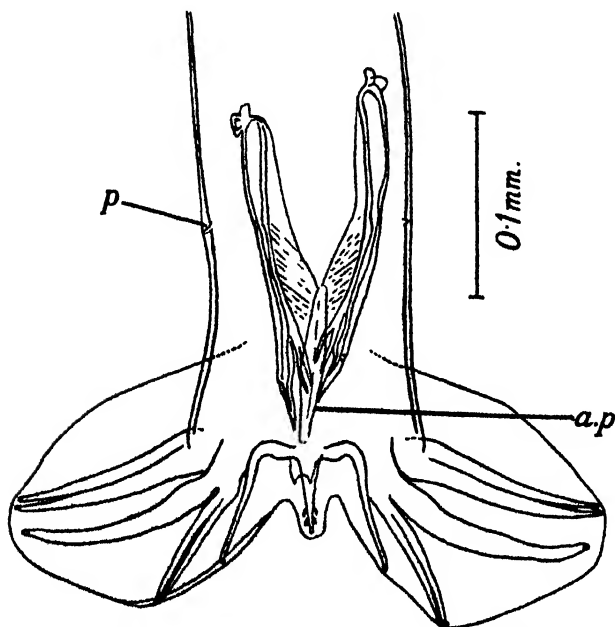
Oswaldocruzia malayana, sp. n. (Figs. 7–11.)

This species occurred in large numbers in the small intestine of a freshwater tortoise, *Heosemys grandis*, at Kedah. The material in Mr. Purvis' collection, all of which apparently came from the same individual tortoise, was in two batches, one consisting of very well extended specimens, the other of less well preserved and

rather shrunken specimens. The following description is based entirely on the well-extended material:—

The male measures 7.6–8.3 mm. in length and 0.11–0.12 mm. in maximum thickness, the female 9–9.9 mm. and 0.12–0.16 mm. respectively. At the anterior end the cuticle is slightly inflated for a distance of 0.12–0.13 mm. The width of the head (fig. 7) is about 0.04–0.045 mm. The cephalic inflation is transversely striated

Fig. 8.



Oswaldocrusia malayana, sp. n. Posterior end of male, with burse spread out; dorsal view.

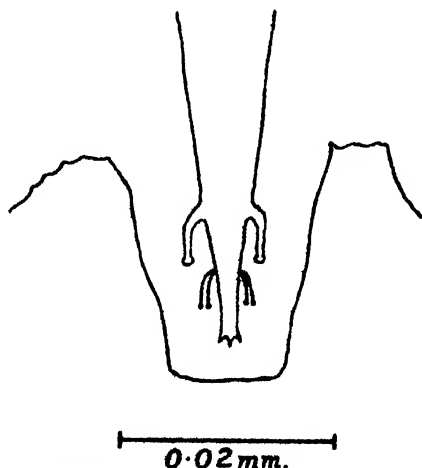
a.p., accessory piece; p, pre-bursal papilla.

and contains numerous granules. Lateral cervical alae are absent. Transverse striations were not observed on the cuticle of the body. There are, however, about twenty-four slight longitudinal ridges. There is also a pair of slight lateral alae. The oesophagus measures

0.42–0.44 mm. in length in the male, 0.46–0.5 mm. in the female. The nerve-ring is situated at about the middle of the oesophagus. No cervical papillæ or excretory pore were detected.

The characters of the bursa of the male (fig. 8) are typical of the genus. The details of the dorsal ray are difficult to make out even under high magnifications. They appear to be as shown in fig. 9. The tip of the ray is apparently very shortly tridigitate, while the stem gives off on either side one relatively stout branch and two exceedingly small, slender branches, which originate

Fig. 9

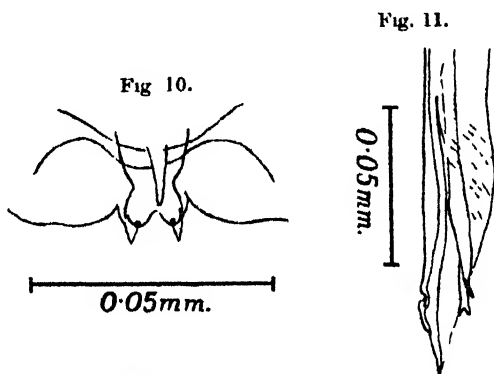


Oswaldoooruzia malayana, sp. n. Dorsal ray of bursa; dorsal view.

at the same level, about halfway between the larger branch and the tip. A pair of prebursal papillæ is present. The genital cone (fig. 10) is produced into a pair of delicate pointed processes, at the bases of which, on the ventral surface, there are two minute papillæ. On the ventral surface of the genital cone there is an elongate, median, papilla-like structure. The spicules (figs. 8 & 11) measure 0.2–0.215 mm. in length. On their inner surfaces they are provided with membranous alæ. The tip of each spicule is divided into three processes (a relatively large

outer process and two inner processes). The outer process is rather conspicuously notched at about the middle of its length on the outer surface. Of the two inner processes one has a simple point, the other is slightly bifurcate at the tip. The accessory piece is narrow and canoe-shaped. It is not heavily chitinized, and its size is rather difficult to determine.

The tail of the female is about 0.16 mm. long, and is rather suddenly constricted near the tip to form a terminal spike measuring about 0.02 mm. in length. There is a pair of caudal papillæ at about 0.062 mm.



Oswaldocruzia malayana, sp. n.

Fig. 10.—Genital cone; ventral view.

Fig. 11.—Tip of right spicule; ventral view.

from the tip. The vulva is situated at about 2.75–3 mm. from the posterior end of the body. The combined length of the ovejectors, including the sphincters, is 0.46–0.6 mm. The eggs measure about 0.08–0.09 mm. \times 0.04–0.045 mm.

Some fourteen species of *Oswaldocruzia* have been described, mostly occurring in Amphibia, but a few in reptiles. Until recently the only species recorded from a tortoise appears to have been *O. leidy* Travassos, 1917. This was based solely upon Leidy's (1856) record of "*Strongylus auricularis* Zeder" from *Cistudo carolina* in North America. Travassos had not seen Leidy's paper, which contains no description of the worm. The

name *O. leidyi* was therefore a *nomen nudum*. Leidy's original specimens appear to have been lost, but Steiner (1924) gives a description of a species collected from *Cistudo carolina* as well as from *Hyla carolinensis*, and assumes that this species is *O. leidyi*. Harwood (1932) records *Oswaldocruzia pipiens* Walton, 1929, as a parasite of *Terrapene carolina triunguis* and *T. ornata*. *O. pipiens* differs from the present form in several respects, notably in the form of the spicules and dorsal ray of the male, and in the presence of cervical alæ.

Of the other species of *Oswaldocruzia*, eight have been more or less adequately described. These are *O. subauricularis* (Rud.), *O. filiformis* (Goeze), *O. insulæ* Morishita, *O. socialis* Morishita, *O. yezoensis* Morishita, *O. molgeta* Lewis, *O. collaris* Walton, and *O. agamæ* Sandground. The species described above does not agree with any of these, or with the *O. leidyi* of Steiner, in the form of the spicules or of the dorsal ray of the male, while many minor differences appear on comparing the individual descriptions. It is therefore considered necessary to regard the species as new.

Family Spiruridæ.

Subfamily *Physalopterinae*.

Physaloptera sp.

Two female specimens, from the stomach of an "iguana" (sc. *Varanus* sp.) at Bukit Berapit, Perak.

Physaloptera sp.

Several larvæ, encysted on the outside of the stomach of a tortoise (unnamed) at Port Weld.

Family Camallanidæ.

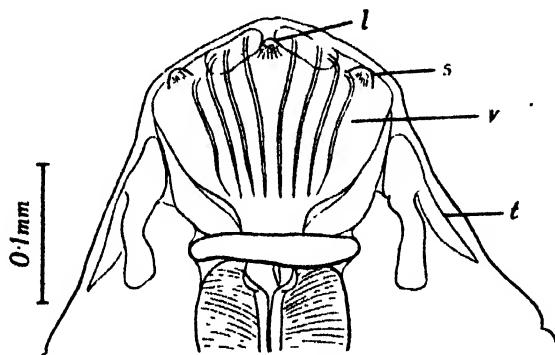
Camallanus octorugatus, sp. n. (Figs. 12-15.)

This species was collected from the small intestine of a freshwater tortoise, *Heosemys grandis*, at Kedah. Two female specimens also occurred in the stomach of an unnamed tortoise at Port Weld.

The male measures 8.6-11.3 mm. in length and 0.38-0.43 mm. in maximum thickness, the female 15.6-19 mm.

and 0.55–0.62 mm. respectively. The head (fig. 12) is relatively narrow, and the neck widens rapidly and forms a well-marked "shoulder" at its junction with the body. The transverse cuticular striations on the body

Fig. 12.

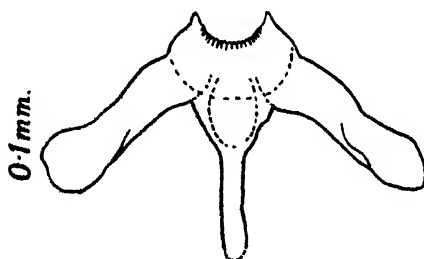


Camallanus octorugatus, sp. n. Anterior end of female; lateral view.

l, lateral papilla; *s*, submedian papilla; *t*, "trident"; *v*, buccal valve.

are at intervals of about 5–6 μ . The buccal valves measure 0.14–0.15 mm. in maximum width in the male and 0.17–0.18 mm. in the female. Their length, including

Fig. 13.



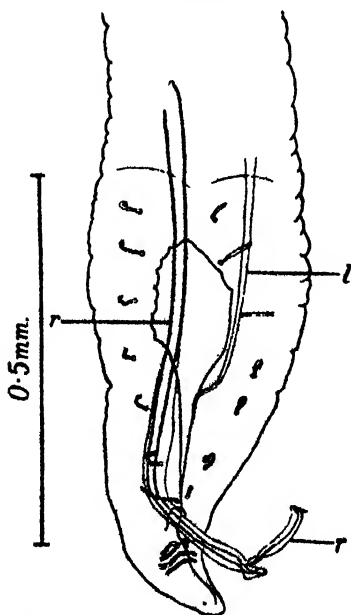
Camallanus octorugatus, sp. n., female. One of the "tridents" in dorso-ventral view.

the posterior ring, is about the same as their width. On the anterior border of each valve there is a pair of internal chitinous thickenings. In all the specimens there are eight longitudinal ridges on the inner surface

of each valve. The dorsal and ventral "tridents" (fig. 12, *t*, and fig. 13) have their three prongs of about equal length. The median prong is narrow and, in lateral view, appears pointed. Its tip is not, however, fully chitinized. The outer prongs are stout and broad-ended. The anterior margin of the base of the "trident" is concave and denticulated.

The distance from the anterior extremity to the posterior end of the oesophagus is 1.28–1.3 mm. in the male and

Fig. 14.



Camallanus octorugatus, sp. n. Posterior end of male; ventral view.

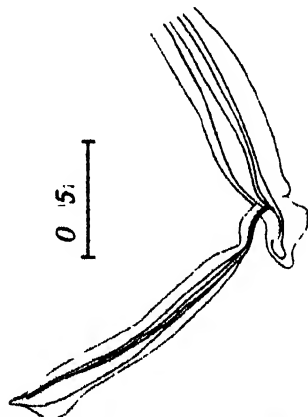
l, left spicule; *r*, right spicule.

about 1.57 mm. in the female. The anterior muscular portion of the oesophagus measures 0.44–0.45 mm. in length in the male, 0.51–0.6 mm. in the female. The posterior granular portion measures 0.68–0.7 mm. and 0.87–0.88 mm. respectively, and has a maximum diameter of 0.14–0.16 mm. in the male and 0.19–0.2 mm. in the female. The nerve-ring is situated at 0.25–0.4 mm.,

the excretory pore at about 0.4 mm., and the very inconspicuous cervical papillæ at about 0.44 mm. from the anterior extremity.

The caudal end of the male (fig. 14) is of the form typical of the genus. It has well-developed lateral expansions, which are fleshy and muscular, continuous across the ventral surface anteriorly, and curled inwards over the ventral surface from the sides, forming a deep elongate groove, near the posterior end of which is the cloacal aperture. The tail measures about 0.13–0.14 mm. in length. The usual seven pairs of pedunculate preanal papillæ are present. There are four similar pairs of postanal papillæ, all placed close together, and apparently

Fig. 15.



Camallanus octosagatus, sp. n. Tip of right spicule, from left side.

* a pair of very minute, sessile, lateral papillæ near the tip of the tail. The spicules are markedly unequal and dissimilar. The left spicule is very feebly chitinized, slender, and apparently measures about 0.5 mm. in length. The right spicule is much stouter and well chitinized. Its length, excluding the lateral appendage, is 0.75–0.76 mm. The tip of this spicule (figs. 14 & 15) has a very remarkable structure, which is constant in all the three male specimens available. The spicule itself has a tubular shaft and, for at least its distal portion, is provided with

membranous alæ. At the tip it gives off laterally a curious appendage, almost at right angles to its long axis. This appendage is about 0.14 mm. long and is composed of an outgrowth from the main shaft of the spicule, thickened distally and likewise provided with membranous alæ. A similar structure apparently occurs in *C. microcephalus* (Duj., 1845) and in *C. nigrescens* (v. Linstow, 1906), though it has not been adequately described.

The tail of the female is 0.24–0.34 mm. long and bears a pair of inconspicuous papillæ at 0.14–0.19 mm. from the tip. The vulva is situated at 6.8–7.8 mm. from the anterior end of the body and has a prominent anterior lip.

Only three recognizable species of *Camallanus* appear to have been described from tortoises up to the present. According to Chitwood*, eight species described from North American hosts are indistinguishable from *C. microcephalus* (Duj., 1845). Törnquist (1931) had already reduced several other species to synonymy. There thus remain only *C. microcephalus*, *C. undulatus* Railliet & Henry, 1915 (= *Cucullanus viviparus* v. Linstow, 1906, nec Bloch, 1782), and *C. kachuga* Baylis & Daubney, 1922. In all these the number of ridges on each buccal valve in the adult is ten or more, while in the present species it is only eight. In *C. kachuga* all the prongs of the "tridents" are pointed, while in the present species the outer prongs are broad.

Family Gnathostomidae.

Subfamily GNATHOSTOMINÆ.

Echinocephalus uncinatus Molin, 1858.

Two larvæ, which are somewhat doubtfully referred to this species, occurred in the stomach of a crocodile* (species not mentioned) at Port Weld. They may perhaps have been derived from some fish swallowed by the crocodile.

Tanqua tiara (v. Linstow, 1879).

This very common species is represented by a number of specimens from the stomach of an "iguana" (so. *Varanus* sp.) at Bukit Berapit, Perak.

* Journ. Parasitol. xix. p. 88 (1932).

Subfamily SPIROXYINÆ.

Spiroxys torquata Karve, 1928.

Three male specimens, which are provisionally referred to this species, occurred in the stomach and small intestine of *Trionyx cartilagineus* at Raub. *S. torquata* was originally recorded from *Emyda granosa* in India.

REFERENCES.

- BAYLIS, H. A. 1920. "A new Siamese Nematode of the Genus *Falcaustra*." *Ann. & Mag. Nat. Hist.* (9) vi. pp. 408-416.
- , & DAUBNEY, R. 1922. "Report on the Parasitic Nematodes in the Collection of the Zoological Survey of India." *Mem. Ind. Mus.* vii. pp. 263-347.
- BHAJERRAO, G. D. 1931. "Two new Parasites from the King Cobra (*Naja hannah*)." *Ann. & Mag. Nat. Hist.* (10) viii. pp. 102-109.
- HARWOOD, P. D. 1932. "The Helminths parasitic in the Amphibia and Reptilia of Houston, Texas and Vicinity." *Proc. U.S. Nat. Mus.* lxxxi. Art. 17, pp. 1-71, pls. i-v.
- LEIDY, J. 1856. "A Synopsis of Entozoa and some of their Ectocoengenora observed by the Author." *Proc. Acad. Nat. Sci. Philad.* viii. pp. 42-58.
- MAPLESTONE, F. A. 1931. "Parasitic Nematodes obtained from Animals dying in the Calcutta Zoological Gardens. Parts 4-8." *Rec. Ind. Mus.* xxxiii. pp. 71-171.
- MORISHITA, K. 1926. "Studies on some Nematode Parasites of Frogs and Toads in Japan, with Notes on their Distribution and Frequency." *Journ. Fac. Sci. Imp. Univ. Tokyo, Sect. IV. Zool.* i. 1, pp. 1-32, pls. i-v.
- ORTLEPP, R. J. 1923. "Observations on the Nematode Genera *Kalicephalus*, *Diaphanocephalus*, and *Occipitodentus* g. n., and on the Larval Development of *Kalicephalus philodryadus*, sp. n." *Journ. Helminthol.* i. pp. 165-189.
- SANDGROUND, J. H. 1929. "A new Liver Fluke from a Monkey and new parasitic Roundworms from various African Animals." *Proc. U.S. Nat. Mus.* lxxv. Art. 12, pp. 1-11, pls. i, ii.
- STEINER, G. 1924. "Some Nemas from the Alimentary Tract of the Carolina Tree Frog (*Hyla carolinensis* Pennant)." *Journ. Parasitol.* xi. pp. 1-32, pls. i-xi.
- TÖRNQUIST, N. 1931. "Die Nematodenfamilien Cucullanidae und Camallanidae nebst weiteren Beiträgen zur Kenntnis der Anatomie und Histologie der Nematoden." *Göteborgs K. Vet.-o. Vitterh.-Saml. Handl.* (5) Ser. B, ii. 3, pp. xi+441, pls. i-xvii.
- TRAVASSOS, L. 1917. "Trichostrongylidas brasileiras." *Brazil Medico*, xxi. 9.
- , 1921. "Contribuições para o conhecimento da Fauna helmintológica brasileira.—XIII. Ensaio monografico da familia Trichostrongylidae Leiper, 1909." *Mem. Inst. Oswaldo Cruz, Rio de Janeiro*, xiii. fac. 1, pp. 5-135, pls. i-lvi.
- WALTON, A. C. 1929. "Studies on some Nematodes of North American Frogs." *Journ. Parasitol.* xv. pp. 227-240, pls. xvi-xx.
- , 1930. "Studies on some Nematodes of North American Amphibia.—II. Cryptobranchidae." *Journ. Parasitol.* xvii. pp. 20-24, pl. i.

LXVIII.—*On a Primitive Dipnoan from the Middle Devonian Rocks of New South Wales.* By EDWIN SHERBON HILLS, Ph.D.(Lond.), Lecturer in Geology in the University of Melbourne.

[Plates XI. & XII.]

IN 1906 Robert Etheridge (fl.) figured and described the head of a large Dipnoan from the Middle Devonian limestones of Taemas, New South Wales, under the name *Ganorhynchus süssmilchi*. Because of the brevity of the description it was not possible to include this species in the subsequent researches on the phylogeny of the Dipnoi, carried out by Prof. D. M. S. Watson and others in amplification of the classic work of Louis Dollo. In view of the known antiquity of the remains, however, Prof. Watson suggested that re-examination might prove interesting, and this was made possible through the kindness of Mr. C. Anderson, Director of the Australian Museum at Sydney, in transmitting the type to Melbourne.

DESCRIPTION.

Genus DIPNORHYNCHUS Jaekel.

Dipnorhynchus süssmilchi (Eth. fl.).

(Pl. XI, figs. 1, 2; Pl. XII, fig. 4.)

Ganorhynchus süssmilchi Eth. fl., 1906.

Locality.—Portion 44, Parish of Taemas, Co. Cowley (Murrumbidgee River), New South Wales.

Horizon.—Middle Devonian, Murrumbidgee Limestones.

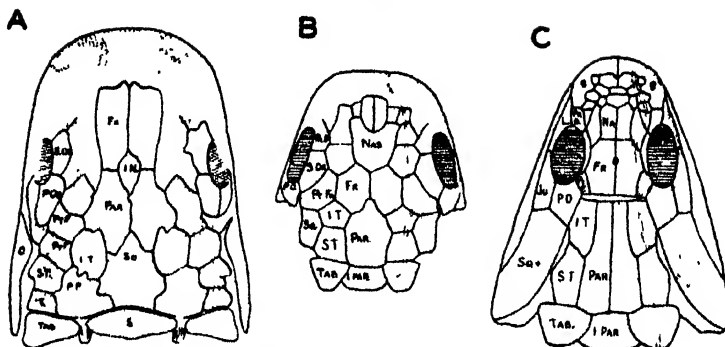
The generic name *Ganorhynchus* was proposed by Traquair in 1873 for the rostrum of a large Dipnoan of unknown provenance, formerly in the old British Museum collection. Smith Woodward (1891, p. 245) has already pointed out that the genus cannot be precisely defined; but, in spite of this, fragmentary rostra from the Catskill and Chemung Series of Pennsylvania (*G. oblongus* Cope, 1892, and *G. beecheri* Newberry, 1889, respectively), and from the Frasnian of Boulonnais (*G. rigauxi* Dutertre, 1929), have been referred to it, as well as the excellent head from New South Wales. It is clearly advisable to discontinue the use of the name for so complete a specimen as that from Taemas, especially as both *G. woodwardi* Traq. (the genotype) and *G. rigauxi* are much

larger (the latter enormously so—it must have been fully 6 feet long from head to tail), show evidence of the presence of teeth on the inner surface of the premaxilla which are lacking in *Dipnorhynchus*, and also differ in details of topography. *Dipnorhynchus süssmilchi* is unique among Dipnoi in that the cranial roof is penetrated by an undoubted pineal foramen and that the tubercles on the dental plate are numerous, small, and show only a tendency towards a linear arrangement.

Cranial roofing-bones.—Detailed interpretation of the cranial osteology of the early fishes has gone hand in hand with the growth of ideas as to the phylogenetic relations of those fishes and the tetrapods. Dollo concluded in 1895 that the ancestor of the Dipnoi had the characters of a Crossopterygian fish, and also showed that the Amphibia probably sprang from a Crossopterygian stock. Subsequently Goodrich (1909, 1925), Gregory (1915), Watson and Day (1916), Watson and Gill (1923), and Watson (1926), have produced evidence which leaves little room for doubt as to the essential truth of Dollo's ideas; but there has been some difference of opinion as to the correct interpretation of the homologies of the bones of the Dipnoan cranial roof, as may be seen from text-fig. 1.

Goodrich (1925) criticized Watson's interpretation of the median series on the grounds that the bone called parietal by Watson shows no evidence of having had a paired origin; that the bones called frontals are situated too far posteriorly; that the nasals do not include the lateral line canal; and that the use of the term pre-nasals for the small bones anterior to the nasals in *Sagenodus* is hard to justify. But Goodrich now admits (1930, p. 304) that there is sometimes a row of bones posterior to the bone he calls median occipital, and that this row is penetrated by the occipital commissure of the lateral line canal. This row is therefore to be considered as containing the tabulars and inter-parietal, and surely, therefore, the "median occipital" is the parietal, as held by Watson. Furthermore, the nasals of *Osteolepis* do not include the lateral line canal (Watson, 1926), and Goodrich himself admits that these canals are not always similarly situated (1925, p. 85). In the interpretation of the cranial roof of *Dipnorhynchus*, therefore,

Text-fig. 1.



- A. Dorsal view of the head of *Dipterus*, after Goodrich, 1930, fig. 311 a.
 B. Dorsal view of the head of *Dipterus valenciennesi*, after Watson, 1926, fig. 2 c.
 C. Dorsal view of the head of *Osteolepis macrolepidatus*, after Watson, 1926, fig. 2 a.

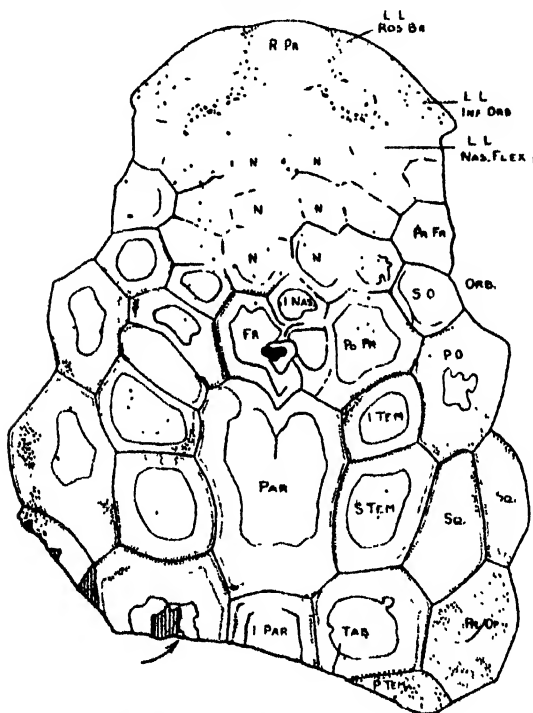
Key to Lettering.

- E.NAR. External nares.
 FR. Frontal.
 I.NAS. Inter-nasal.
 I.PAR. Inter-parietal.
 I.TEM. Inter-temporal.
 JU. Jugal.
 L.L.INF.ORB. Infra-orbital branch of the lateral line.
 L.L.NAS.FLEX. Circum-nasal flexure of the lateral line.
 L.L.OC. Occipital commissure of the lateral line.
 L.L.ROS.BR. Rostral branch of the lateral line.
 L.L.SOC. Supra-orbital branch of the lateral line.
 N. Nasal.
 NAS. Nasal.
 NAS.CAP. Position of nasal capsule.
 O. Operculum.
 ORB. Orbit.
 PAR. Parietal.
 PO.FR. Post-frontal.
 PO.O. Post-orbital.
 PR.FR. Pre-frontal.
 PR.O. Pre-orbital.
 PR.OP. Pre-operculum.
 P.TEM. Post-temporal.
 PT.FR. Post-frontal.
 R.PR. Rostral prominence.
 S. Median post-occipital.
 SO. Median occipital.
 S.O. Supra-orbital.
 SQ. Squamosal.
 S.T. Supra-temporal.
 T. Pre-tabular.
 TAB. Tabular.

the author has accepted Watson's homologies, and their essential verity is attested by the new evidence this skull presents.

In *Osteolepis* the pineal foramen is situated in the frontal area, and it seems reasonable to consider that it penetrates the same region in *Dipnorhynchus*. Thus

Text-fig. 2.

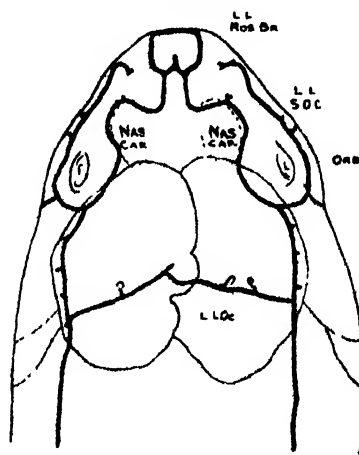


Dorsal view of the head of *Dipnorhynchus*, natural size. Drawn from a photograph, the cheek-bones being slightly out of proportion due to their greater distance from the lens. Viewed with the dorsal middle line horizontal.

the unsymmetrical bones bordering the foramen are considered to be frontals. At the sides of these are the post-frontal ossification, a single bone on the right-hand side, represented by two or three on the left. These are

penetrated by pores from the lateral line canal and situated correctly with regard to the presumed supra-orbital, post-orbital, and inter-temporal bones. The true homology of the large median bone posterior to the frontals must be clear not only from comparison of the position of the pinal foramen in *Dipnorhynchus* and *Osteolepis*, but also from the arrangement of bones in the posterior part of the skull. It is the parietal. There is indeed an indication that it was derived from the fusion of paired elements, as is suggested by the subdivision of the ornament of the anterior border.

Text-fig. 3.



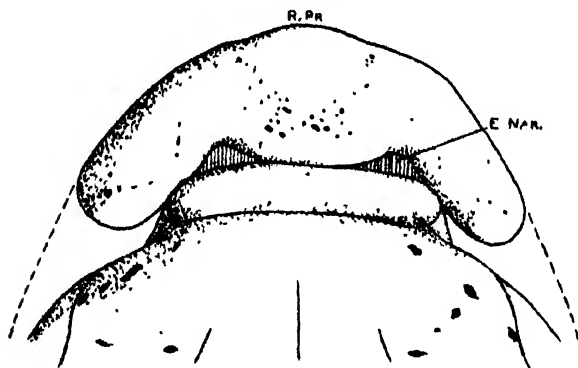
Dorsal view of the head of *Epiceratodus*, showing the position of the nasal capsules with respect to the lateral lines. Course of the latter after Goodrich, 1930, fig. 722.

The posterior termination of the skull is marked by the smooth, gently curved edge of the bones marked P.TEM. and Pr.OR. in text-fig. 2. The post-temporal is readily recognized, and in front of it is a row of three bones immediately behind the parietal. That in the middle line is the inter-parietal, at the sides of which lie the tabulars. On the left-hand side of the specimen a small longitudinal canal penetrates the tabular at the position shown by the arrow in text-fig. 2, while on the right the roof of a corresponding canal has been broken

through in the rear. These canals are regarded as having contained the sense-organs of the lateral line system, although they seem rather small. The lateral line pores are somewhat irregularly placed, but the disposition suggests that the canals traverse the series of bones dorsal to the circumorbital and cheek-bones. This series is therefore considered to represent the tabulars, supra-temporals, post-frontals, and, anteriorly, small bones whose homologies are not clear. The solid rostrum covering the ethmoidal and nasal region has clearly resulted from the fusion of a number of small bones with the premaxillæ.

In *Epiceratodus* the nasal sacs are situated beneath the area circumscribed by the flexure of the supra-orbital

Text-fig. 4.

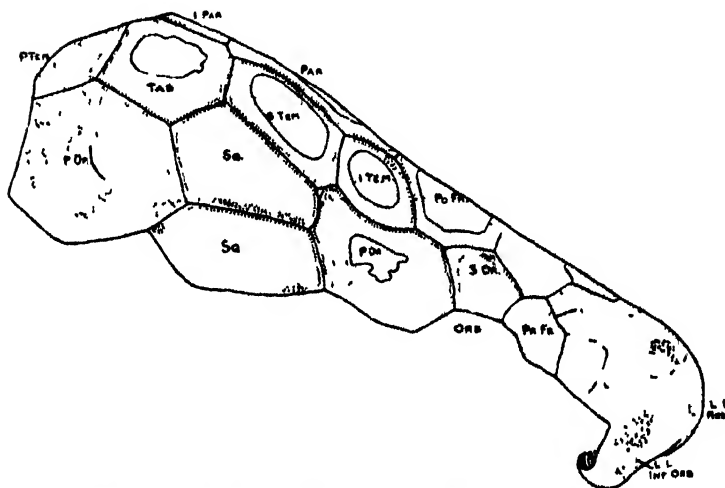


The under surface of the snout of *Dipnorhynchus*, showing the suggested relation with the front of the lower jaw.

lateral line canal anterior to the orbit (see text-fig. 3), and in *Osteolepis* the nasals are situated within a similar flexure (see text-fig. 1), the canal itself penetrating an adjacent series of small bones. It is therefore suggested that in *Dipnorhynchus* the elements marked N. in text-fig. 2 are to be regarded as nasal ossifications. The rostral prominence is probably ethmoidal, as it lies between the external nares and dorsal to the premaxillæ in the middle line. The premaxillæ must be represented by only the lower part of the snout, judging from the position of the nares, and their posterior lateral terminations are rounded

bosses, against which Traquair suggested that the maxillæ articulated in the case of the similar structures in *G. woodwardi*. The author believes, however, that a more probable explanation is that the anterior termination of the lower jaw, whose general outline must have been very similar to that of *Dipterus platycephalus* (Agass.) figured by Watson and Gill (1923), fitted into the ventral side of the rostrum somewhat as shown in text-fig. 4. The arrangement is suggestively similar to that in *Epiceratodus*, in which the upper lips fit closely round the front of the lower jaw (Pl. XII. figs. 1, 2).

Text fig. 5.



Side view of the head of *Dipnorhynchus*, natural size. Drawn from a photograph, the cheek-bones being slightly out of proportion due to their nearness to the lens.

In the cheek region there are three bones preserved on the right-hand side, represented by two on the left. The hinder edge of the bone marked P. O. in text-fig. 5 is smooth and bears a shallow groove, apparently connected with the articulation of the operculum. Thus the bone in question is considered to be the pre-operculum and those in front of it as equivalent to the squamosal—

represented by a single bone on the left-hand side. The reduction of the cheek region is much less than is shown by any other Dipnoan, and it is clear that the operculum must have been situated far back on the head, in a position resembling that of *Osteolepis*. From this it may be inferred that the shortening of the jaws, that is so characteristic of the Dipnoi as a group, was in *Dipnorhynchus* not yet very far advanced.

The bones surrounding the orbit—post-orbital, supra-orbital, and pre-frontal—are slightly protuberant from the general surface of the skull, the orbits being situated well forward but relatively far apart, as in other Dipnoi.

Dental Plate.—According to both palæontological and embryological evidence the later Dipnoi with strong crushing tooth-plates are derived from early forms possessing a dentition of isolated denticles supported on a bony base (Semon, 1899). These denticles became arranged, for more efficient trituration, into radiating rows distinct from the primary rows, and finally fused into ridges. Etheridge referred in the original description of *Dipnorhynchus süssmilchi* to a tuberculated plate on the underside of the specimen, and this is clearly a tooth-plate (Pl. XII. fig. 4). Even in *Dipterus tuberculatus* Pander (Pl. XII. fig. 3), the most primitive type of dental plate previously known, the isolated denticles are arranged into radiating rows, but in *Dipnorhynchus* the denticles are not only very small but also exhibit no more than a tendency towards a linear disposition. In the inner angle of the dental plate the surface has been worn smooth, testifying to the wear the structure had to withstand and to the maturity of the actual individual under consideration. In comparison with the size of the head the tooth-plate seems particularly small.

Geological Age of Dipnorhynchus.—The Murrumbidgee Limestones, in which the fish was discovered, are of Middle Devonian age, but the palæontological and field evidence (summarized by Benson, 1922) is not conclusive as to whether they are to be referred to the Upper (Givetian) or the Lower (Eifelian) part of that series, though Prof. David in his latest work (1932) places them in the Givetian. The geology of the Murrumbidgee Limestones has been described by Harper (1909).

CONCLUSION.

The most remarkable feature in the anatomy of *Dipnorhynchus süssmilchi* is the possession of a pineal foramen. In the fishes, amphibia, and reptiles the penetration of the cranial roof by the pineal or parapineal organ is in general a primitive feature, and in the case of *Dipnorhynchus* this may be taken as an indication of the retention of ancestral characters not exhibited by any other known genus. It is interesting therefore to note the resemblance to the Crossopterygii in the possession of a pineal foramen.

A well-established evolutionary trend in the Dipnoi is the reduction of the number of dermal cranial ossifications with time. *Dipnorhynchus* possesses the most generalized type of cranial roof yet discovered among the Dipnoi. Not only are single bones in later forms represented here by two or even three elements, but the development is often unsymmetrical. Clearly this cannot be due to degeneration, but is a primitive condition, analogous to the unsymmetrical plate development of the early echinoderms. The complete encasing of the snout in bone, as in *D. platycephalus*, suggests that the lack of ossification of this region in *D. valenciennesi* Sedg. & Murch., which slightly antedates *D. platycephalus*, is a secondary feature.

The tooth-plate, as has been shown, is very primitive. This being so, it would be expected that the jaws would not show the striking shortening connected with the durophagous habit exhibited by later and more specialized forms, and that therefore the cheek region would be less reduced and the operculum situated further back. All these characters are indeed shown by *Dipnorhynchus süssmilchi*, which must therefore be regarded as the most primitively organized Dipnoan yet discovered. It occurs, however, in limestones which are perhaps younger, certainly not older, than the Stromness Beds, and is to be considered as a representative of a persistent relatively non-specialized stock.

The author is indebted to Prof. W. E. Agar for a critical perusal of the manuscript and to Mr. G. S. Sweeting for kindly undertaking the correction of the proofs of this paper.

BIBLIOGRAPHY.

- BENSON, W. N. 1922. "Materials for the Study of the Devonian Palaeontology of Australia." *Rec. Geol. Surv. New South Wales*, vol. x. pt. 2, pp. 83-204.
- COPE, E. D. 1892. "On some new and little-known Palaeozoic Vertebrates." *Proc. Amer. Phil. Soc.* vol. xxx. pp. 221-229.
- DAVID, T. W. E. 1932. 'Explanatory Notes to accompany a new Geological Map of the Commonwealth of Australia.' Sydney.
- DOLLO, L. 1895. 'Sur la Phylogénie des Dipneustes.' Brussels.
- DUTERTRE, A. P. 1929. "Découverte d'ossements de Poissons dans le Dévonien du Boulonnais." *C. R. Acad. Sci. t. cxxxviii.* no. 17, pp. 1116-1118.
- ETHERIDGE, R. (fil.). 1906. "The Cranial Buckler of a Dipnoan Fish, probably *Ganorhynchus*, from the Devonian Beds of the Murrumbidgee River, New South Wales." *Rec. Aust. Mus.* vol. vi. pt. 3, pp. 129-132.
- GOODE, E. S. 1909. 'Vertebrata: Craniata.' London.
- . 1925. "On the Cranial Roofing Bones in the Dipnoi." *Journ. Linn. Soc. Lond., Zool.* vol. xxxvi. no. 241, pp. 79-86.
- . 1930. 'Studies on the Structure and Development of Vertebrates.' London.
- GREGORY, W. K. 1915. "The Present Status of the Problem of the Origin of the Tetrapoda, with Special Reference to the Skull and Paired Limbs." *Ann. N.Y. Acad. Sci.* vol. xxvi. pp. 317-383.
- HARPER, I. F. 1909. "The Geology of the Murrumbidgee District, near Yass." *Rec. Geol. Surv. New South Wales*, vol. ix. pt. 1, pp. 1-54.
- O. JAEKKEL. "Der Kopf der Wirbeltiere." *Zeitschr. gesamt. Anat.* Abt. iii. 1927, p. 933.
- NEWBERRY, J. S. 1889. 'The Palaeozoic Fishes of North America.' *Mon. no. xvi. U.S. Geol. Surv.*
- SEMON, R. 1899. "Die Zahnentwicklung des *Ceratodus forsteri*." *Jena. Denkschr.* Bd. iv. pp. 115-135.
- TRAQUAIR, R. H. 1873. "On a new Genus of Fossil Fish of the Order Dipnoi." *Geol. Mag.* vol. x. pp. 552-553.
- WATSON, D. M. S., & H. DAY. 1916. "Notes on some Palaeozoic Fishes." *Manchester Mem.* vol. ix. pt. 2, pp. 1-62.
- & E. L. GILL. 1923. "The Structure of certain Palaeozoic Dipnoi." *Journ. Linn. Soc. Lond., Zool.* vol. xxxv. pp. 163-216.
- . 1926. "The Evolution and Origin of the Amphibia." *Phil. Trans. Roy. Soc. Lond. ser. B.* vol. ccciv. pp. 189-257.
- WOODWARD, A. S. 1891. 'Catalogue of Fossil Fishes in the British Museum.'—Part 2. London.

EXPLANATION OF THE PLATES.

PLATE XI.

- Fig. 1. Dorsal view of the head of *Dipnorhynchus süssmilchi*, taken with the dorsal middle line horizontal. Natural size.
- Fig. 2. Ventral surface of the snout of *Dipnorhynchus süssmilchi*. Slightly enlarged.

PLATE XII.

- Fig. 1. Palate of *Epiceratodus forsteri*. Natural size.
- Fig. 2. Buccal surface of the lower jaw of *Epiceratodus forsteri*. Natural size.
- Fig. 3. Tooth of *Dipterus tuberculatus*. $\times 8\frac{1}{2}$.
- Fig. 4. Tooth of *Dipnorhynchus süssmilchi*. Natural size.

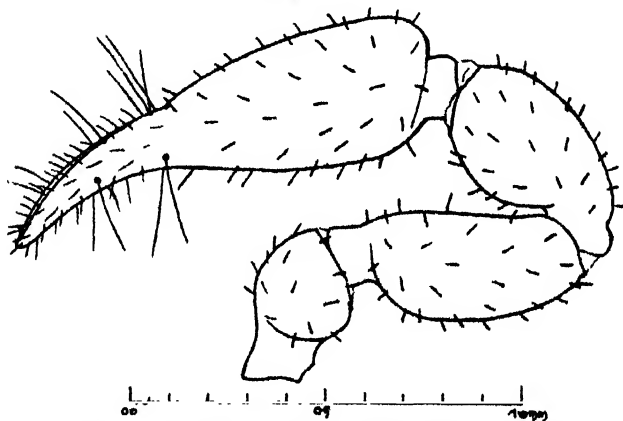
LXIX. --Two new Species of *Cheliferinea*
(Pseudoscorpionidæ). By Dr. M. BEIER, Vienna.

THROUGH the kindness of Sir Guy A. K. Marshall I have received for study a number of *Cheliferinea* belonging to the Imperial Institute of Entomology. The two following species of this material are new, and the types are in the British Museum.

Haplochernes incrassatus, sp. n. (Fig. 1.)

Carapace a little longer than broad, much enlarged posteriorly, granulated distinctly in lateral, weakly in medial region; transverse furrows very flat and

Fig. 1.



Haplochernes incrassatus, sp. n. Right palp of the female.

not prominent. Eye-spots absent. Hind margin of the carapace convexly rounded. Galea long, with short processes distally. Serrula with 15 teeth. Flagellum with 3 blades, the distal one serrated. Tergites 1 to 3 and 11 undivided, the others weakly divided. Setæ of the body blunt. Pedipalpi very stout, distinctly granulated, the granulae on the medial side of the femur and tibia rasp-like and sharp. Trochanteral protuberances rounded. Femur 2.2 times, tibia 1.9 times, chela 3.1 times, as long as broad. Hand narrow. Fingers much shorter than the hand. Fixed finger medially

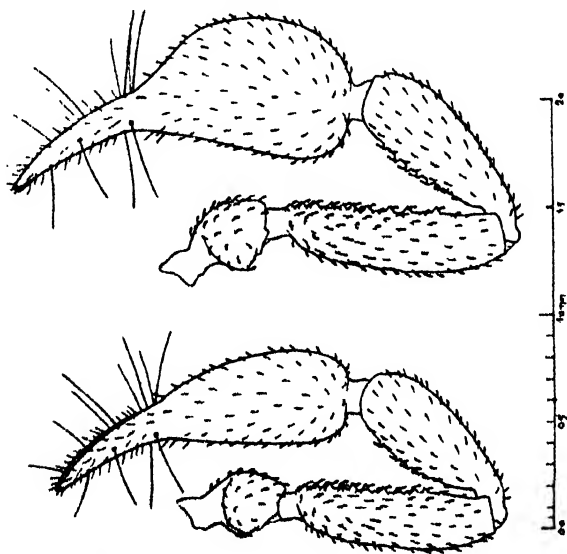
with 3, laterally with 8 accessory teeth; movable finger medially without, laterally with 5 accessory teeth.

Length of body, ♀, 3 mm.; femur, length 0.63 mm., breadth 0.28 mm.; tibia, length 0.58 mm., breadth 0.32 mm.; hand, length 0.75 mm., breadth 0.37 mm.; fingers, length 0.53 mm.

Type, 1 ♀, Australia, Victoria, Upper Fern Tree Gulley, 1928 (*T. D. A. Cockerell*).

Differs from the other species in the incrassated femur and tibia of the pedipalps.

Fig. 2.



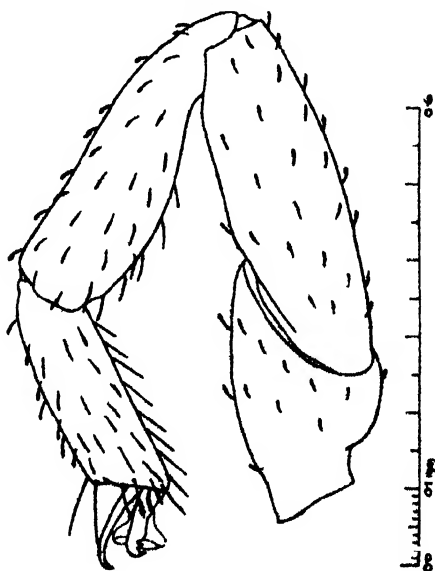
Hansenius mirabilis, sp. n. Right palps of male (above) and female (below).

Hansenius mirabilis, sp. n. (Figs. 2 & 3.)

Carapace a little longer than broad, distinctly granulated, laterally with a number of larger granulae; both transverse furrows deep and distinct, the posterior one nearer to the hind margin of the carapace than to the anterior furrow. Eyes large, but flat. Galea of the male short and simple, that of the female with teeth

terminally. Flagellum with 3 blades. Serrula with 18 to 19 teeth. All the tergites divided, with 8 to 9 marginal and several premarginal setæ. The first five of the male with distinct lateral keels. Setæ of the body short and distinctly club-shaped. Pedipalpi on the medial side of the femur and tibia with large and tooth-like granulæ, externally and above finely granulated

Fig. 3.

*Hansenius mirabilis*, sp. n. Fore leg of the male.

with several larger granulæ. Trochanteral protuberances with a tubercle terminally. Femur of the male 3.9 times, of the female 3.8 times, tibia of the male 3 times, of the female 2.8 times, chela of the male 2.5 times, of the female 3.2 times, as long as broad. Hand of the male swollen laterally, of the female normal. Fingers much shorter than the hand. Fore tarsus of the male thickened, claws asymmetrically developed, one of these long and slender, the other stout and with a subterminal tooth. The subterminal seta of the tarsus dentate.

Length of body, ♂♀, 2-2.5 mm.; femur, length, ♂ 1.09 mm., ♀ 0.99 mm., breadth, ♂ 0.27 mm., ♀ 0.27 mm.; tibia, length, ♂ 1.00 mm., ♀ 0.90 mm., breadth, ♂ 0.32 mm., ♀ 0.32 mm.; hand, length, ♂ 1.05 mm., ♀ 0.93 mm., breadth, ♂ 0.62 mm., ♀ 0.47 mm.; fingers, length, ♂ 0.72 mm., ♀ 0.64 mm.

Types, 7 ♂♂, 5 ♀♀, East Africa, Tanganyika Territory, Morogoro, in coconut crown, xi. 1930 (*W. I. Harris*).

Differs from the other species of the genus principally in the remarkable sexual dimorphism of the palpal chela, because the hand of the male is very much enlarged.

LXX.—*Contributions towards a Knowledge of the European Thysanoptera*.—IV. By RICHARD S. BAGNALL, D.Sc., F.R.S.E.

THIS is continued from *Ann. & Mag. Nat. Hist.* ser. 9, xx. pp. 561-585 (Dec. 1927), and contains the descriptions of *Æolothrips citricinctus*, *Oxythrips forticornis*, *Anaphothrips discrepans*, *A. johani*, *Physothrips gentianæ*, *P. villetti*, *Thrips poultoni*, *Cratothrips priesneri*, and *Megathrips lesnei*, spp. n.

Of these *Æolothrips citricinctus* and *Megathrips lesnei* are North African species from the collections of the Paris Museum, whilst *Thrips poultoni* is a Canary Island species from a small collection made by Professor E. B. Poulton, F.R.S., in 1914, and presented to me on his return.

Since my last contribution I have had little opportunity of extending my researches abroad. In the August of 1929 I spent a profitable few days collecting on the sand-hills in the neighbourhood of St. Cecile Plage and Étapes, adding further to our knowledge of the French Thysanoptera, whilst shortly after my return I found it necessary to make a hurried visit to the South-Eastern part of Czecho-Slovakia (Moravia). Journeying to Vienna *via* Cologne and Würzburg I managed to do a little collecting in the Wiener Wald, Mödling and the Bruhl Valley, Laxenberg, and Baden. My opportunities of collecting in Moravia were very limited and disappointing, but a few additions were made to Uzel's list of Czech Thysanoptera, including two new species of *Haplothrips*.

Returning to Vienna, I travelled overnight to Villach, in Carinthia, a delightful little town on the swift-running Drave, dominated on the south by the crags of the Karawankan and the jagged peaks of the Julian Alps, and situated within a short walk of the boundaries of Yugo-Slavia and Italy, but a short 60 miles from the Adriatic. Trips were made to Warmbad-Villach, the Kanzel (4885 feet) overlooking the Ossiacher See, and to Radentheim with its magnesite mines and works; and though there were frequent heavy afternoon rains some interesting discoveries were made, including *Euphysothrips minozzii* Bagn. and the two fine species *Megathrips bonnannii* Uz. and *Cratothrips priesneri*, sp. n., all new to the Austrian fauna.

On the homeward journey a few days were spent at Cortina d'Ampezzo and Bolzano in the Dolomites, and many additions to the known Italian Thysanoptera were made (including the discovery of *Physothrips gentianæ*, sp. n.), whilst short stays at Innsbruck and Zurich completed a very interesting but all too hurried journey.

In various papers on the British Thysanoptera published since 1927 I have described the following twelve species:—

1928, Ent. Month. Mag. lxiv. pp. 95–99, 130–132, and 153–156.—*Odontothrips anthyllidis*, *O. inermis*, *Physothrips flavus*, *P. inequalis*, and *Baliothrips exilis*, spp. n.

1930, loc. cit. lxvi. pp. 47–50.—*Melanothrips harrisoni*, sp. n.

1932, loc. cit. lxviii. pp. 161–165.—*Æolothrips anthyllidis*, *Dendrothrips peucedani*, *Haplothrips marrubiicola*, *H. senecionis*, and *H. juncicola*, spp. n.

1933, loc. cit. lxix. (in press).—*Cryptothrips williamsi*, sp. n.

In a paper on the genus *Chirothrips* (1932, Ent. Month. Mag. lxviii. pp. 183–187) I have described *Chirothrips similis* Bagn. var. *productus* nov., *C. ambulans*, *C. laingi*, and *C. angusticornis*, spp. n., from Europe.

In a special study of the difficult genus *Haplothrips* (1933, Ann. & Mag. Nat. Hist. ser. 10, xi. pp. 313–334) I described, amongst others, the following European species collected by myself in France and Czechoslovakia:—*Haplothrips sedicola*, *uzelianus*, *microsetosus*, *tenuicornis*, *satanas*, *malibæki*, *propinquus*, *phyllireæ*, and *quadrati-ceps*, spp. n.

In the following descriptions I have pleasure in dedicating species to Professors Poulton and Priesner, to the Russian thysanopterist Oscar John, and to the French entomologists the late André Vuillet and P. Lesne.

Suborder TEREBRANTIA.

Æolothrips citricinctus, sp. n.

This species belongs to the recently diagnosed *deserticola* Pr.-*anthyllidis* Bagn. group, agreeing in the broad fore-wings, the distal dark band of which commences at the cross-veins, and, as in these species, the ♂ belongs to the *ericæ* and not the *fasciatus* type. It comes nearer to *anthyllidis* than *deserticola* and differs markedly from both in the relative lengths of antennal joints (especially the long third joint) and the coloration of the antennæ and pronotum.

Measurements (in microns) of type :—

Length (and breadth) of head and pronotum 175 (216) and c. 202 (262), dorsal length of eye 70–72; length (and breadth across distal third) of fore-wing c. 1260 (224); length of hind tibia 365. Median length of tergites 9 and 10 152 and 108, and lengths of their longest bristles 200 and 190 respectively. Total length 1.9–2.0 mm.

Relative lengths (and breadths) of the antennal joints 3–8 compared with allied species approximately :—

Æ. citrinctus, sp. n. 146 (30) : 118 (29) : 98 (30) : 27 (25) :
16.5 (18) : 15.5 (14) : 17 (9) μ .

Æ. anthyllidis Bagn. 130 (32) : 110–120 (30) : 100 (30) :
24 (24) : 20 (20) : 19 (15) : 16 (8) μ .

Æ. deserticola Pr. 112 (24) : 78 (24) : 64 (25) : 20 (20) :
17 (17) : 17 (13) : 20 (7) μ .

General colour brown to chestnut brown; head, intermediate and hind legs dark blackish-brown. Pronotum with a belt across the anterior part citrous yellow—in all the examples the anterior angles are of this colour, but I find it difficult to determine the coloration of the disc; under a low-power lens, however, the pronotum appears to be short and exceptionally transverse, due to the posterior 0.6 or thereabouts being sharply brown compared with the pale anterior belt.

Second antennal joint citrous yellow, sometimes clouded basally, third joint similarly coloured with either a narrow

ring of dark brown at the extreme apex or shaded brown in the distal fourth or thereabouts, terminating in a darker distal ring.

Fore-wings with the extreme base and the two bars palish brown, shorter than in *deserticola* or *anthyllidis*, and with the basal pale area medianly 1.6 times as long as each of the four subsequent areas, these being medianly approximately subequal. Setæ on veins sparing and minute. Elongated sensoria of antennal joints 3 and 4 long as described for *deserticola*, and that on 4 running into the basal third as in that species.

♂.—Abdomen (except apex) yellowish, processes of sternites 4–6 much as described for *deserticola*, but the pair on 6 not so rudimentary; ninth abdominal segment much as in *deserticola*, *anthyllidis*, and *ericæ*.

Type. Mus. de Paris.

Hab. N. AFRICA, Tangier. Several ♀♀, v. 1901 (*G. Buchet*). MOROCCO, "O. Judios, partie moyenne de la v. et collins de la rive droit (*G. Buchet*)," both sexes; Tunis, Le Ket, 2 ♀♀, 1911 (*Dr. Normand*).

Oxythrips forticornis, sp. n.

♀.—Fragile. Length c. 1.0 mm., breadth of abdomen 0.24 mm.

Colour pale to deeper yellow, dark brown spot at apex of each tarsus and at apex of mouth-cone. Fore-wings with yellowish tinge, setæ fumate. Basal antennal joints 1 and 2 pale milk-white, 2 very lightly tinged with grey, 3 yellowish tinged with grey, 4 and 5 more heavily tinged with grey, especially distally, and 6–8 light grey-brown.

Head markedly transverse, front straight, cheeks slightly widened behind eyes, mouth-cone long and pointed; antennal joints 3 and 4 short and broad, much as in *perniciis* Bagn., nearly 2.4 times as long as the head, with the relative lengths (and breadths) of joints as compared with *O. quercicola* ♀ approximately as follow:—

O. forticornis, sp. n. 32.5 (19) : 31 (20) : 28 (c. 16) :
38 (18) : 6.3 (6.8) : 10 (5.4) μ .

O. quercicola Bagn. 41 (19) : 38 (19) : 32 (18) :
47 (19) : 8 : 15 μ .

Pronotum transverse, 1.33 times the length of the head and about 1.63 times as long as broad, bristle at each hind angle straightish, fumate, c. $32\ \mu$. Setæ of fore-wings longish, fumate, those on veins near middle c. $27\ \mu$ in length, increasing to c. $40\text{--}42\ \mu$ near tip; costa with 19 setæ, upper vein with $4+3$ basally and $1+2$ or $1+1+1$ in the distal half and 8 or 9 on the lower vein; cilia of upper margin sparse, moderately long, curved, those on lower vein long, close, and wavy. Abdomen elongate-ovate, much as in *quercicola*, the longest postero-lateral bristles on segments 9 and 10 respectively 81 and 65, the mid-dorsal pair on 10 being the longest, viz., c. $82\ \mu$. Length (and breadth) of head 81 (132), of pronotum 108 (162), and of fore-wings 540 (40) μ .

This species comes nearest to *O. quercicola* in its general form and in the very short head, the measurements being 81 (132) as compared with 94 (154) μ in *quercicola*; it is a more delicate species and sharply distinguished by the shape of the intermediate antennal joints, which are much stouter in comparison with their length, in this respect approaching *O. pernicios* Bagn., the male of which alone is as yet known. In both *pernicios* and *quercicola* the second joint of the antennal style is twice, or approximately twice, as long as the first, instead of a little more than 1.5 times as long in this species. The setæ of the fore-wings are fewer than in *quercicola*, namely, 19 and 8-9 on the costa and the lower vein as compared with 29 and 11 in *quercicola*.

Hab. FRANCE, Arcachon, mouth of the Teste, 1 ♀ by sweeping, viii. 26.

The known European species of the genus are now as follows:—

O. nobilis Bagn.
O. brevistylis (Tryb.).
O. dentatus Knecht.
O. inopinatus Pr.
O. halidayi Bagn.
O. ulmifoliorum (Hal.).
O. navasi Bagn.

O. tristis Bagn.
O. ajacis Uz.
O. quercicola Bagn.
O. virginialis Pr.
O. cannabensis Knecht.
O. forticornis Bagn.
O. pernicios Bagn.

Anaphothrips discrepans, sp. n.

♀.—Although of the size and general build of the *gracillimus* Pr.-*debilis* Bagn. section, this species comes nearest to *obscurus* (Müll.), agreeing with that species

in its type of coloration, in the form of the antennæ (in which the sixth joint is diagonally divided), and in the wing and abdominal chaetotaxy.

The species is a small and slender edition of *A. obscurus*, and differs, apart from its slenderness, in the relative lengths of the antennal joints, most noticeably the small fourth antennal joint, which is not more than 0.8 as long as 3 (compared with 0.9 to 0.95 in typical examples of *obscurus*).

Length to fore-margins of eyes (and breadth) of head 108 (135); breadth of abdomen 243 and length of forewings $675\ \mu$, as compared with 135 (181); 356 and $890\ \mu$ in *obscurus*. Bristles at end of abdomen much as in *obscurus*, but only 0.8 as long as in that species.

The relative lengths (and breadths) of antennal joints 3-8 compared with typical *obscurus* are approximately as follow :—

A. discrepans, sp. n. 40.5 (19) : 32.5* (17) : c. 38 (18) :
45 (18) : 9 and $11\ \mu$.

A. obscurus (Müll.). 48 (21.5) : 43 + (21) : 45 (20) :
56 (19.5) : 11 and $14.5\ \mu$.

Hab. FRANCE, Arcachon, females only, at the mouth of the Teste, by sweeping *Juncus* etc., viii. 26.

Anaphothrips secticornis Tryb., 1896.

Hab. ITALY, Dolomites, several ♀♀, chiefly on grasses, Pordoi Pass, and 1 ♀ in a flower of *Gentiana asclepiadas* on the shores of the Lago di Misurina, ix. 29.

Anaphothrips sordidus Uz.

Hab. ITALY, Dolomites, 1 ♀ on *Silene* from near Bolzano, at from 3000-4000 feet, ix. 29.

Anaphothrips silvarum Pr.

Apparently widely distributed on *Galium verum*; records from France, Italy, Switzerland, Austria, and Czecho-Slovakia.

Anaphothrips atroapterus Pr.

Hab. FRANCE, Eastern Pyrenees, Orlu, on *Convolvulus* sp., and L'Hospitalet, on *Sedum* sp., viii. 26; single female example on each occasion.

* $31\ \mu$ in one example out of four.

Anaphothrips gracillimus Pr.

This species was described by Priesner (who possessed both the brachypterous and macropterous forms) from Austria and Hungary.

Hab. FRANCE, females only, three brachypterous and one macropterous, from grasses (! *Phalaris*) on the dunes at St. Cecile Plage, viii. 29.

Anaphothrips johni, sp. n.

♀.—Intermediate between *A. debilis* Bagn. and *A. gracillimus* Pr., being smaller and markedly more slender than *debilis* and about the same build, but slightly more slender than *gracillimus*. The head is longer than in *debilis*, but shorter in comparison with its breadth than in *gracillimus*, whilst the pronotal setæ are short (c. $13\ \mu$) as in *debilis*. The "comb" of the eighth abdominal tergite is short, the average length of the median setulæ being about $12\ \mu$ compared with $15\text{--}16\ \mu$ in *gracillimus*, whilst the longest bristles of segment 9 are about $80\ \mu$ in length compared with $95\text{--}100\ \mu$ in my examples of *gracillimus*.

♂.—Eighth tergite furnished with two pairs of dorsal spines, the outer pair on a slightly higher level, being c. $13.5\ \mu$, and the inner pair c. $11\ \mu$ in length, these spines being flanked by a pair of strong bristles on a higher plane, $48\ \mu$ long, separated by c. $43\ \mu$.

I have a good deal of unworked material belonging to this group of the genus, and reserve a closer description until later.

Hab. S. FRANCE, Plage d'Hyères, ix. 27, both sexes from grass on the "Salins" and Tamaris, 1 ♀, iii. 27, on *Erica arborea*.

Euphysothrips minozzii Bagn.

Hab. AUSTRIA, Villach, ♀♀ in flowers of *Clematis vitalba*, ix. 29. Originally described from the South of France.

Physothrips gentianæ, sp. n.

This species comes nearest to *vulgatissimus* and *meridionalis*, and differs from both in the form of the antenna and the relative lengths of the intermediate joints. It possesses a yellow male.

♀.—Length 1.4 to 1.5 mm.

Colour dark brown, abdomen and head darker than the rest of the body; legs, especially the tibiae and tarsi, yet lighter; wings uniformly yellowish-grey, setae dark. Antenna with joints 1 and 2 concolorous with (or slightly paler than) the head and 5–8 of a uniform blackish-brown; 3 greyish-yellow, 4 brown but not so dark as 5, and inclined to yellowish-brown basally.

Head broader than long, broadest across cheeks, which are arcuate; eyes large, prominent, setose; anterior ocellus protected by a pair of longish setae at a slightly lower level. Antennae about 2.5 times as long as the head, style short, as is common to the section; joints 4 and 6 subequal in length, shorter than 3 and longer than 5, which is c. 0.75 the length of 4 or 6; strongly forked trichome on 3 and 4 seated on a noticeable constriction. Pronotum transverse, not much longer than the head; bristles at hind angles long, the inner slightly longer than the outer and about 0.75 the length of the pronotum; three pairs of minor postero-marginal setae, the two outer pairs short, but the inmost pair quite 0.5 as long as the postero-angulars. Wing-setae long, distal half of upper vein with usually 1+1+1 setae; costa and lower vein with 24–28 and 12–16 respectively. Bristles of the ninth abdominal segment long, 165–180 μ , but the inner pair only c. 0.7 as long as the outer, viz., c. 120 μ . Comb of tergite 8 short (15–16.5 μ) and sparse.

♂.—Yellow, more or less suffused with grey. Antennal joints 1–3 yellowish, 4–8 coloured as in the ♀.

Abdominal segment 10 with pair of darkish long curved bristles, c. 120 μ in length; 9 with a shorter straight bristle (c. 90 μ) at each hind angle.

Dorsal setae on 9 consisting of a shorter, more widely separated, curved pair (c. 33 μ), and, set on a lower plane, 4 equidistant longer setae, the inner pair being on a slightly higher plane than the outer and c. 45 μ in length.

Measurements in microns :—

	♀.	♂.
Length (and breadth) of head	133 (180)	130 (168)
" " pronotum	150 (225)	135 (200)
Length of "bristles :		
Pronotal postero-angular	c. 100	c. 75
Pronotal inmost postero-marginal	54	36

Relative lengths (and breadths) of antennal joints 3-8 approximately as follows:—

♀. 69 (c. 27) : 59 (25.5) : 43.5 (22.5) : c. 60 (c. 24) : 9 + 12 μ .

♂. 67.5 (24) : 58 (24) : 39 (22) : 55.5 (24) : 9 + 9 μ .

Hab. ITALY. This is the common species found in the flowers of the Gentians of the Dolomites at 5000-6000 feet. Both sexes occurred in numbers on *Gentiana klusii* near Cortina d'Ampezzo (c. 5000 feet), and in *G. asclepiadea* near the shores of the Lago di Misurina at c. 6000 feet, September 1929.

Physothrips dianthi Pr.

♂ (previously unknown).—Yellow, the body more or less shaded with grey; antennal joints 1-4 pale, 2 and 4 lightly shaded with grey, 5 shading to light grey-brown distally, and 6-8 light grey-brown. Stout setæ on third antennal joint dark.

Wings fragile, small, much as in the female but paler.

Upper pair of terminal abdominal bristles each situated at angle, moderately stout and strongly curved, about 115 μ in length; lower pair (placed immediately underneath) scarcely curved, a little more slender and about 105 μ in length. Ninth tergite with a short and very stout pair of black spines 27 μ in length and c. 7.5 μ in breadth. Eighth tergite with "comb."

The female has been previously recorded from *Dianthus* spp. by Priesner from Austria and Dalmatia, and by myself from the Republic of Andorra, France, and Spain.

Hab. ITALY, Bolzano district, ♀♀ only in flowers of *Silene* at 3000-4000 feet; Cortina d'Ampezzo, ♀♀ and 1 ♂ in flower of *Gentiana klusii* at about 5000 feet, ix. 29.

Physothrips vuilleti, sp. n.

♀.—Near *Physothrips friçi* Uz., but at once separated by the exceptionally long antenna (the third joint of which is approximately 2.7 times as long as broad and substantially longer than the sixth), the long pronotal bristles, the chaetotaxy of the fore-wings, the complete comb of abdominal tergite 8, and the short dorsal bristles of tergite 9.

Body blackish-brown; fore-tibiæ yellow lightly shaded with brown, and all tarsi yellow. Fore-wings and cilia grey-brown; bristles dark blackish-brown. Antennæ with joints 1 and 2 concolorous with head; 3-5 pale yellow, 5 shaded lightly with grey distally; 6-8 pale grey-brown, 6 pale basally.

Length (and breadth) of head and pronotum 150 (204) and 165 (240) μ respectively; length of postero-angular and postero-median pronotal setæ 72-78 and 35 μ respectively. Breadth of pterothorax 350 and length (and breadth) of fore-wing 900 (65) μ .

Comb of tergite 8 complete but sparse, the longest setulæ lateral, only c. 12 μ in length. The longest bristles on abdominal segments 9 and 10 c. 135 μ , the mid-dorsal pair on 10 being as long as the longest on 9, the dorsal pair on 9 only c. 42 μ in length as compared with 60-70 μ in my examples of *friçi*.

The relative lengths (and breadths) of the antennal segments are approximately as follows:—

30 (34) : 42 (29) : 63-65 (24) : 52 (23) : 38 (21) : 52 (21) :
8 : 14 μ .

Long slender bristles on intermediate antennal joints, those on 2-4 being 30-32 μ in length.

Fore-wings much as in *friçi*, but the upper vein with 3-4 setæ in the distal half, either 1+1+1 or 1+1+1+1 (in *friçi* 1+2 with a long space between); costa with 26-28 and lower vein with 14-16 setæ as compared with 21-25 and 9-13 in *friçi*.

Hab. EASTERN PYRENEES, Banyul-sur-Mer, 1 ♀ on a Carlina thistle, and Perpignan, 1 ♀ from flower of *Clematis vitalba*, viii. 26.

Thrips poultoni, sp. n.

This minute species runs down to *timidus* Pr. and *prætermisus* Pr., and agrees with the former in its more minute and slender form, pale coloration, and the longer and more slender antennal style.

♀.—Length about 1.0 mm.

Measurements in microns:—

Length of head about 90 and breadth across eyes and across cheeks 135 and 145 respectively. Length

(and breadth) of pronotum c. 110 (165); length of postero-angular and postero-median bristles 45-50 and 17-21 respectively. Breadth of abdomen c. 260; length of bristles of segment 9 60-66 and 78; dorsal pair 30-33 separated by 63; those of segment 10 approximately 80 and 75. Length of fore-wing c. 620; costa with 22-25 setæ, upper vein with 4+3 basal and 1+1+1 distal setæ and lower vein with 13 setæ.

Tergite 8 with comb which is apparently short but difficult to distinguish, as the solitary example is mounted ventrally.

Length of antenna c. 210; lengths (and breadths) of joints 2-7 approximately 33 (25) : 37 (21) : 34 (20) : 33 (18) : 42 (19) : 13 (7).

The species is at once distinguished from *Thrips timidus* by its broader and more transverse head and pronotum (135-145 and 165 μ broad respectively, as compared with 110 and 134 μ in *timidus*), its comparatively stouter antennæ, and more particularly its shorter antennal style (13 compared with 15-17 μ). The pronotal and wing-bristles are more slender and the antennal joints 3 and 4 are less arcuate laterally compared with those in a paratype of *T. timidus* in my possession.

Hab. CANARY ISLANDS, Las Palmas, 28. vi. 14, several ♀♀ (all but one of which unfortunately perished in an accident) collected by Prof. E. B. Poulton, F.R.S.

Thrips robustus Pr.

Hab. ITALY, Dolomites, 1 ♀, f. *macroptera*, from a flower of *Gentiana bavarica* and 1 ♀, f. *brachyptera*, in the minute flower of *Gentiana nana*, near the Pordoi Pass at about 7000 ft., ix. 29.

Thrips ebneri Karny.

Hab. FRANCE, Villefranche-Saône, 29. vi. 27, on *Centaurea jacea* with *T. angusticeps* Uz., with which the species was confused (ex. O. John). Previously known from Sicily and Tunis.

Thrips urticae (Fabr.) Pr., nec Hal., Uzel.

Since rediscovering this species Priesner has recorded it from Germany, Austria, and Hungary, whilst I have recorded it in England.

Hab. AUSTRIA, Igls, near Innsbruck. ITALY, Bolzano. FRANCE, near Étapes, ix. 29, females only on *Urtica*.

Epithrips uzelianus Pr.

Hab. SWITZERLAND, Lugano, viii. 29, 1 ♀, collected by Mr J. Johnstone Mann. Recently described from Hungary.

Suborder TUBULIFERA.

Cratothrips priesneri, sp. n.

♀.—Length c. 2.25 mm., breadth of pterothorax 0.49 mm.

Dark greyish to blackish-brown; antennal joint 3 yellowish, shaded with grey-brown, especially at the sides and in the distal half, 4 and 5 yellowish in the basal third and fourth respectively. Wings fumate, with brownish streaks medianly and more lightly fumate basally (except for the dark basal scale) and distally. Bristles pale.

Head approximately as broad behind eyes (where it is broadest) as long; cheeks narrowing towards the base. Antennæ widely separated (142 and c. 55 μ across base and space between respectively), 1.7 times as long as the head; joints 7 and 8 fused in one mass, with an indistinct suture. Eyes small, 80 μ long, separated by c. 135 μ . Legs short, fore-tarsus armed with a stout tooth.

Pronotum transverse, all bristles present, those at hind angles about 95 μ in length, anterior and mid-lateral pairs shorter. Wings as in *Cryptothrips*; fore-wings with 10–11 duplicated cilia; sub-basal bristles dilated at tips, arranged in the form of a triangle, 1 and 2, 2 and 3, and 1 and 3, separated by 30, 28.5, and 54 μ respectively, and their lengths 60, 57, and 71 μ respectively.

Abdomen not much broader than the pterothorax, intermediate segments strongly transverse; tube stout, 0.75 the length of the head.

Measurements in microns :—

Length (and breadths behind eyes and near base) of head 304 (304, 280); length (and greatest breadth) of pronotum 190 (400); breadth of fifth abdominal segment c. 550; length (and breadths at base and at apex) of tube 216 (94 : 47). Longest bristles on abdominal

segments 7-9 approximately 230-240, 135, and 225 ; terminal hairs weak, c. 215.

Lengths (and breadths) of antennal joints 3-7+8: 87 (46) : 80 (44) : 79 (38.5) : 76 (38.5) and 57+35 (35) μ respectively.

Hab. AUSTRIA, Warmbad-Villach, near Villach, 1 ♀, with *Cryptothrips latus* Uz. and *Megathrips bonnannii* Uz., by beating a log, ix. 29.

Cryptothrips williamsi Bagnall, 1933.

Ent. Month. Mag. lxi. (in press).

A ♂ example from Poland, ex coll. Schille, is referable to this very recently described species.

Megathrips bonnannii Uzel.

Hab. AUSTRIA, Warmbad-Villach, near Villach, ix. 29. A single example of each sex of this fine species was taken with *Cratothrips priesneri* m. and *Cryptothrips latus* on a log. A sudden and violent thunderstorm precluded further search.

Megathrips lesnei, sp. n.

♂.—Length c. 4 mm., breadth of pterothorax 0.675 mm.

Colour chestnut-brown, femora (especially at their apices) and the drepanæ of the sixth abdominal segment inclined to yellowish-brown; tibiæ and tarsi yellow, shaded to brown below the knee, and especially on the outer margin. Wings lightly fumate, both upper and lower wing having a poorly defined brown patch suggestive of an ill-defined median vein running to the distal half. Antennal joints 1 and 2 brown, the latter somewhat lighter distally, 3 pale yellow, with apical 0.2 or thereabouts lightly tinged with grey-brown; 4 and 5 similarly yellow, but with the distal 0.3 and 0.4 or thereabouts respectively brown; 6-8 broken off in the unique example. Bristles colourless.

Head constricted behind eyes and slightly swollen and produced for reception of antennæ; ante-ocular and postocular setæ apparently weak but difficult to make out, the postocular pair situated just below a line across the hind margins of eyes; a second dorsal pair is situated behind the postoculars (separated by c. 80 μ)

and 70–75 μ in length. Genal spines sparing, colourless, pair behind eyes slightly curved, blunt, and 40–42 in length, others 25–38 μ long. Drepanæ of abdominal segment 6 almost straight, very slightly outwardly directed and very slightly curved distally, reaching to about the middle of segment 7, which has a short, broad, tooth-like swelling near posterior angles; 8 armed with a lateral tooth-like process before each posterior angle; tube about 1.37 times as long as the head; minutely setulose in the basal half and more sparingly so distally.

Measurements in microns :—

Length to a line drawn across fore margin of eyes (and breadth across eyes and across basal fourth) of head 650 (256 : 262); lateral length of produced part (and breadth at base of antennæ) 23 (110); dorsal length of eye 130, length (and greatest breadth near base and near middle) of tube 700 (120 : 85); length (and greatest breadth) of pronotum (which is malformed) 200 (400); length (and breadth near middle) of fore wings c. 1750 (130); length (and breadth near middle) of tibia i. 400 (82), ii. 430 (80), and iii. 580 (70).

Length of bristles (which are colourless and slightly dilated at apex) of fore-femur on outer margin near middle 82–100; of antero-angular and postero-angular pronotal bristles 80 and 100 respectively; of longest postero-angular bristles on abdominal segments 7–9 approximately 160–175, 125–135, and c. 95 respectively; of terminal hairs (which are pale and weak) 230; and of dorsal setulæ of tube near middle c. 26–28.

Length (and breadth near apex) of antennal joints 1–5 approximately 60 (48) : 68 (38) : 268 (41) : 202 (41) : 190 (40).

Wings closely ciliate, upper wing with c. 30 duplicated cilia.

This species comes near the Japanese species *quadrituberculatus* Bagn. and *honoris* Bagn., and differs from both in the shorter intermediate antennal joints. In its general colour and form and in its shorter tube and drepanæ it more closely approaches *honoris*; in *lesnei* the tube is somewhat shorter, and the setulæ (which are between 0.6 and 0.7 the breadth of the tube near middle in *honoris*) are insignificant and only about 0.3 the width

of the tube near middle, whilst the drepanæ are substantially shorter, being but 0·6 as long as in *honoris*. Thus it is easily separated from *honoris* by the minutely setulose tube.

Type. Mus. de Paris.

Hab. ALGERIA, Ravin de la Femme Sauvage, in the environs of Algiers, xii. 92 (*P. Lesne*).

Cephalothrips sparticola Bagn.

Hab. FRANCE, Haute Pyronées, 1 ♂ and larvæ found by Mr. Randall Cooke in the neighbourhood of Gavarnie, vi. 30.

Haplothrips distinguendus Uzel.

Hab. BALKAN STATES, Vardar Mission, 1 ♀ (accidental) on *Verbascum* sp., 1910 (R. Michel) with *Neoheegeria verbasci* (Osb.).

Neoheegeria verbasci (Osb.).

Hab. BALKAN STATES, Vardar Mission, both sexes in numbers on *Verbascum* sp., 1910 (R. Michel), per Paris Museum.

LXXI.—*Osmundites from Central Australia* By W. N. EDWARDS, British Museum (Natural History).

A FRAGMENT of a petrified fern-stem, collected by Dr. Herbert Basedow in the MacDonnell Range, Central Australia, has recently been presented by him to the Geological Department of the British Museum (Natural History); on microscopical examination the specimen proves to be *Osmundites dunlopsi* Kidston and Gwynne-Vaughan. It consists of a stem surrounded by the characteristic zone of osmundaceous leaf-bases accompanied by numerous roots; the diameter of the specimen is about 10×6 cm. The preservation of the tissues is distinctly poor, but fortunately the xylem cylinder, 4–5 mm. in diameter and enclosing a parenchymatous pith, is sufficiently well preserved to show that the xylem is continuous or almost continuous, and not broken up into separate strands, thus agreeing with the Jurassic species *O. dunlopsi*.

In addition to extending the range of this species Dr. Basedow's discovery is of importance because it indicates the presence or former existence of Jurassic rocks in the MacDonnell Ranges. The exact locality is south of Paddy's Waterhole, Eastern MacDonnell Ranges (Arltunga), Central Australia, and, so far as I know, no Mesozoic rocks have yet been identified in this region.

Dr. Basedow writes :—"Specimens are quite plentiful in this locality, but they are always found lying upon the surface; I have not found any *in situ*. Apparently they have weathered out of a thin bed of Jurassic rocks of which there is no direct evidence available except the fossils. The low hills occurring in the neighbourhood consist of gneissic rock, and are here and there covered with a deposit of later Tertiary alluvium."

The type-specimen of *O. dunlopi* was stated to be from "Jurassic rocks near Gore, Otago district, New Zealand," though Arber believed that it probably came from Waikawa, Southland. In any case several specimens of identical preservation have since been found at Waikawa (some collected by D. G. Lillie are in the Geological Department of the British Museum), associated with a flora which Arber considers to be Middle Jurassic. The species has also been recorded from elsewhere in New Zealand: in 1914 Sinnott (Ann. Bot. xxviii. p. 471) described as *O. dunlopi* a well-preserved specimen which had been handed to him by Dr. P. Marshall, from Kawhia, North Island, and what is obviously part of the same specimen was described in 1926 by Marshall himself (Trans. N.Z. Inst. lvi. p. 210) as a new species, *Osmundites aucklandicus*, though curiously enough he does not refer to Sinnott's paper, nor does he discuss in what respects the new species differs from *O. dunlopi*, from which it does not appear to be clearly distinguishable. The specimen was associated with a Cephalopod fauna, suggesting an uppermost Jurassic age. Sahni has recorded *O. dunlopi* from the Walloon series (Jurassic) of Queensland, and the specimen of *Osmundites* sp. from Queensland figured by Kidston and Gwynne-Vaughan (Trans. Roy. Soc. Edin. l. 1914, p. 478), which from the structure of the petiole might possibly belong to *O. dunlopi*, is, according to Dunstan (in Sahni, Queensland Geol. Surv.

267, 1920, p. 11), very probably from beds of Walloon age, and not "Miocene" as first stated. The specimen described by Stopes as *O. kidstoni* from Wollumbilla Creek, Queensland ("probably Cretaceous"), again has a similar petiole; as Posthumus has shown (Ann. Bot. 1924, p. 215) the supposed stele of this plant is a foreign intrusion, and the *Osmundites* must be regarded as unidentifiable.

Petrified osmundaceous stems, or masses of leaf-bases in which the stele is not preserved, have been found in other parts of Queensland and also in New South Wales (there is a poorly preserved specimen, hitherto unrecorded, in the British Museum from the Liverpool Range), but with the exception of *O. gibbiana* from the Walloon series of Harrisville they are not specifically identifiable and are of uncertain age, either Mesozoic or Tertiary.

LXXII.—Notes on new and little-known Orthoptera from Palestine. By B. P. UVAROV, British Museum (Natural History).

THE following notes and descriptions are based partly on the material communicated from time to time to the Imperial Institute of Entomology by Dr. F. Bodenheimer and by the Government Entomologist of Palestine, and partly on the re-examination of specimens collected by Dr. P. A. Buxton, on which a report has been published some years ago (Bull. Soc. Ent. Egypte, 1923, pp. 167-214).

The types of all new species are deposited in the British Museum collection.

Mantides.

Eremiaphila brunneri Werner.

1905. *Eremiaphila brunneri* Werner, Sitzber. Akad. Wiss. Wien, cxiv. p. 384.
 1917. *Eremiaphila sacra* Giglio-Tos, Bull. Soc. Ent. Ital. p. 80.

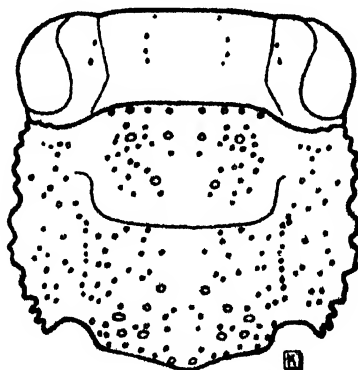
The original description of *E. brunneri* (from Jerusalem) is very brief, and no mention can be found in it of the coloration of anterior femur. This apparently caused Giglio-Tos to include it in the group of species with the femora not marked with black, and to describe a species
Ann. & Mag. N. Hist. Ser. 10. Vol. xi. 45

(also from Jerusalem) with such markings as new. However, Dr. M. Beier has, at my request, examined the type of *E. brunneri*, and found it to agree in every respect with the description of *E. sacra*. I am grateful to Dr. Beier for his assistance in clearing up this synonymy and the permission to publish it.

Eremiaphila ammonita, sp. n. (Fig. 1.)

Somewhat similar in the laterally denticulate pronotum to *E. moreti* I. Bol., *E. denticollis* Lucas, and *E. dentata* Sauss., but differing from all of them in the denticulation being very much stronger, apart from a number of other characters.

Fig. 1.



Eremiaphila ammonita, sp. n.

♀.—Of medium size, uniformly pale ochraceous; legs faintly banded.

Head slightly narrower than the pronotum; vertex seen from the front moderately convex; lateral furrows of the vertex fine and shallow.

Pronotum transverse; surface broadly gibbose, with sparse but acute tubercles. Anterior margin broadly prominent in the middle, sinuate laterally. Lateral margin feebly convex, very strongly crenate. Posterior lateral angle three-denticulate. Posterior margin very strongly emarginate laterally, with a broad trapezoidal

projection occupying more than the middle third of the margin.

Elytra slightly longer than head and pronotum together, more coarsely rugulose laterally than on the disc; underside with a metallic blue-black semilunar spot somewhat removed from the apex, narrowed forwards and not reaching the hind margin; the spot not perceptible from above. Wings large, consisting of two broadly rounded and sharply divided sections, the posterior one smaller; underside with a blue-black band extending over both sections; the band is removed from the outer margin by 2 mm. in the anterior sector and by about 1 mm. in the posterior, where it becomes broader and diffused towards the base; the band is visible from above as well, other parts of the wing being coriaceous like the elytron.

Total length 25; length of pronotum 6; maximum width of pronotum 7; length of elytron 9; length of hind femur 10 mm.

TRANSJORDANIA: Amman, 25. viii. 1921, 1 ♀ (type); 16. ix. 1921, 1 ♀ (*P. A. Buxton*).

This species was incorrectly recorded by me (*Bull. Soc. Ent. Egypte*, 1923, p. 170) under the name *E. genei*, from which it differs in the coloration of hind wings and in the shape of pronotum.

Tettigonidae.

Paradrymadusa phylbyi Uv.

This species has been described by me (*Ann. & Mag. Nat. Hist.* ser. 9, vol. xix. p. 272) from Amman, Transjordan, but now I have before me two males and a female from Brunner's collection in Vienna (kindly submitted to me by Dr. M. Beier) labelled "Jerusalem, Reitter." The males are slightly smaller than the type but do not differ from it in the genitalia or in any other structural characters. The female hitherto has not been known, and its description follows:—

♀.—Subgenital plate rounded-trapezoidal, transverse, with a distinct median carinula and a small notch on the hind margin. Ovipositor less than twice the length of pronotum, distinctly recurved.

Total length 27; pronotum 9; elytron 5; hind femur 24.5; ovipositor 15 mm.

Acerididae.*Stenohippus bonneti orientalis*, subsp. n. (Fig. 2.)

Differs from the typical form (of Tunisia) by slightly smaller size and by relatively much shorter elytra, which scarcely extend beyond the hind knees, by the frontal ridge gradually and very little narrowed at the fastigium, and by relatively longer pronotum.

	<i>bonneti</i> .		<i>orientalis</i> .	
	♂.	♀.	♂.	♀.
Length of body	15	20	14	21
" " pronotum	2.5	4	3	4.5
" " elytra.....	16	19.5	13	17
" " hind femur....	9	11.5	8.5	11

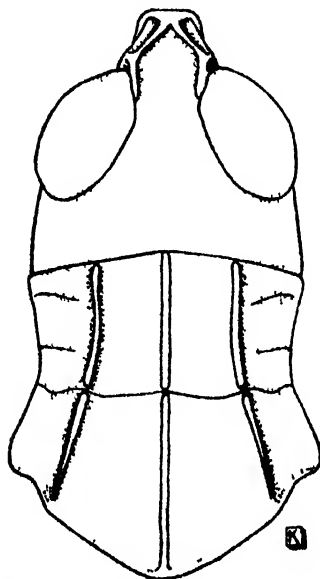
Stenobothus bonneti was described by I. Bolivar long ago ('Le Naturaliste,' 7^e année, no. 15, p. 116), but it was only in 1926 (Trans. Ent. Soc. London, 1926, p. 425) that I made clear its generic position by including it in my genus *Stenohippus*. My action was based on the description alone, but now I have the types before me (kindly sent by Dr. C. Bolivar), and their study confirms my view. The types are a male from Gura el Fedjej (this is selected by me as the holotype) and a female from Bled Thala, both in Tunisia.

Palestinian specimens are very close to the types, but differ in the few characters mentioned above, which appear to justify us in regarding them as representatives of a new subspecies. It must be noted that all species of this genus are somewhat variable individually, and particularly unstable appears the shape of pronotal keels. These keels are usually almost parallel in the prozona in the specimens marked with black lateral fasciae, but in the specimens without such fasciae the keels tend to become more inflexed in the prozona. This variability makes the separation of species extremely difficult and uncertain, the more so as the structure of the head and the venation supply only very insignificant and uncertain characters. It is not impossible that a thorough revision of the genus would reveal some useful critical characters, but the material at present is scanty.

The genus *Stenohippus* appears to be restricted to the driest savannas of Africa, extending its range into Arabia

and North-western India, with isolated species occurring north of the desert-belt, where they can be regarded as relics of a former extension of the savanna fauna.

Fig 2



Stenohippus bonneti orientalis, subsp. n., ♀.

The type and paratypes of *St. bonneti orientalis* are from the following localities:—

Jericho, 5. viii. 1929 (type); 22. viii. 1929; 25. vii. 1929; 8. viii. 1929; 15. v. 1928, 5 ♂♂, 2 ♀♀ (*Y. Tapukhi*); 17. iv. 1925, 1 ♀ (*Bodenheimer*).

BODENHEIMERELLA, gen. nov.

Allied to the genus *Eremippus* Uv. (subfam. Acridinae), but differing from it in the structure of the head, abbreviated elytra, and reduced number of spines on the posterior tibiae.

Antennae relatively stout, filiform.

Head ascending, particularly in the male. Face strongly oblique. Frontal ridge straight in profile, forming an acute angle with the fastigium of vertex, distinctly but

not deeply sulcate in both sexes; its margins obtuse, not quite straight, the ridge being slightly narrowed below the ocellum and widened again below it. Fastigium of vertex slightly sloping; its surface hexagonal, concave, margins well raised and extended backwards between the eyes. Foveolæ placed almost vertically in the male and very obliquely in the female, moderately concave, broad behind and strongly narrowed in front, about half as long again as their greatest width. Eyes large.

Pronotum moderately compressed laterally, more so in the male, in which sex it is also somewhat constricted in the middle. Upper surface moderately convex. Median carina obtuse, nearly obsolescent in the middle, more distinctly raised in the metazona. Lateral carinæ developed in the anterior third and in the metazona, obsolete in the middle third. Only the typical sulcus developed on the upper surface, and it is placed well behind the middle. Metazona distinctly transverse, rounded behind.

Prosternum with a low transverse swelling. Mesosternal interspace strongly transverse, even in the male much wider than one of the lobes. Metasternal lobes broadly separated in both sexes.

Elytra not reaching the apex of the abdomen. Mediastinal field scarcely expanded near the base, reaching about the middle of the anterior margin in the male and extending beyond the middle in the female. Scapular field strongly expanded, particularly in the male, in which sex the hind radial and the false vein are weak and irregular, the field between the second radial and the first ulnar being filled with large elongate cells. In the female all main veins and the false vein are straight. Anal area broad.

Abdomen with the tympanum half closed. Male external genitalia of the usual type. Valve of the ovipositor short, stout, with blunt teeth.

Hind tibia with 8-9 outer and 9-10 inner spines, without the outer apical spine. Pulvilli between claws, small, narrow.

Bodenheimerella jordanica, sp. n. (Figs. 3 & 4.)

♂ (type).—Small, slender.

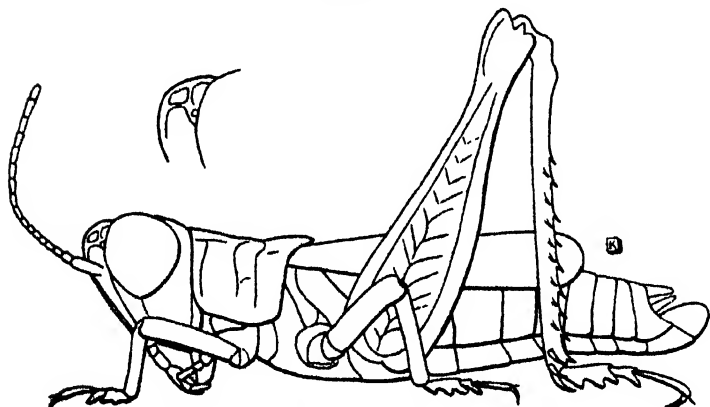
Antennæ somewhat longer than head and pronotum together, slightly incrassate in the apical half.

Fastigium of vertex about twice as long as broad, sides subparallel, apex angular, about 60° .

Lateral pronotal keels in the prozona distinct only in front of the first sulcus, slightly convergent towards it; in the metazona they are more widely distant, feebly divergent backwards.

Elytra reaching the base of the anal plate and the middle of hind femur, gradually widened from base to about the apical fifth; the apex is broadly elliptical, anterior margin is practically straight except near the apex; posterior margin regularly and broadly curved

Fig. 3.



Bodenheimerella jordanica, gen. et sp. n.

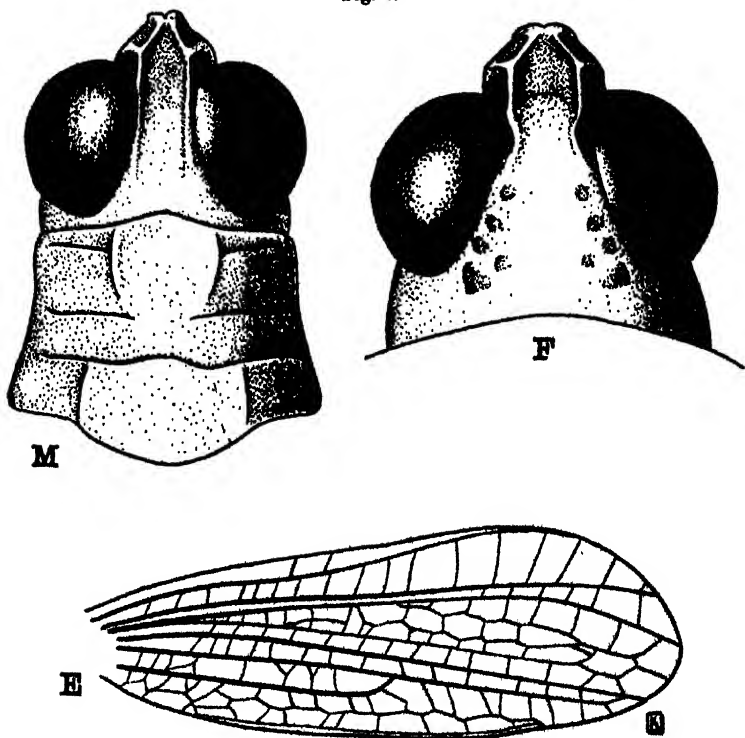
Side-view of the male; top of the head enlarged.

throughout. Scapular area greatly expanded, reaching almost the apex, with very sparse transverse veins forming very few large cells. First and second radial veins quite close to each other and straight up to the apical quarter, where they are somewhat divergent and bent backwards. Third radial very thin and irregular, branching off from the second about its middle and forming with it a broad field with very large cells. Discoidal field with a very irregular false vein, with a double row of large and strongly elongated cells. Ulnar veins thick and straight; the interulnar field opaque, with a single series of long cells. Anal field broad, opaque, with large

irregular cells. Wings about two-thirds the length of elytra.

Last tergite with a shallow and broad median emargination and a pair of very short broad lobules. Supra-anal plate triangular. Cerci small, cylindrical, with conical apex. Subgenital plate short, blunt.

Fig. 4.



Bodenheimera jordanica, gen. et sp. n.

M, male; F, female; E, male elytron.

General coloration very pale sandy (the type has been preserved in alcohol), with some brownish markings similar to those in the paratypic female described below.

♀.—Fastigium of vertex about half as long again as broad. Elytra reaching the middle of hind femora and not covering the whole of abdomen, less expanded than

in the male, with the apex parabolic; all the main veins practically straight, with a single series of elongated cells between each two veins.

General coloration pale sandy, with numerous chocolate-brown dots and streaks. Head partly whitish, especially the face. Pronotum dotted with chocolate-brown; lateral keels in their anterior section margined with blackish brown on the outside; hind margin with some blackish streaks. Elytra with some brown spots in the pre-radial area and interrupted blackish streaks along the principal veins. Front and middle femora spotted with black; similar spots on the tibiae forming irregular rings. Hind femora above with four incomplete chocolate-brown fasciae; all keels with black streaks; hind tibiae faintly bluish, with blackish spots.

Total length, ♂ 10, ♀ 14; pronotum, ♂ 2.5, ♀ 3; elytra ♂ 5, ♀ 6; hind femur, ♂ 6.5, ♀ 8.5 mm.

Described from two males (one the type) and one female, taken in the Jordan Valley about halfway between Jericho and the Jordan (*F. Bodenheimer*).

It gives me great pleasure to dedicate this interesting insect to Dr. F. Bodenheimer, whose systematic exploration of Palestinian fauna throws much new light on the problem.

Chorthippus dorsatus palæstinus, subsp. n. (Fig. 5.)

Differs from the typical North European form by the larger size, more rounded fastigium of vertex, characteristically curved lateral pronotal keels, which are straight and parallel in the prozona and strongly divergent in the metazona, elytra with more regular and thicker cross-veins, wings infumate in the apical half, male abdomen red above in the apical third, lower valvæ of the ovipositor stout and armed with a rounded tooth.

Differs from the South Russian subsp. *loratus* F.-W. (see Znoiko, Rev. Russe Ent. xxii. 1928, p. 188), with which it agrees in size, mainly in the shape of pronotal keels, which in that subspecies are usually quite straight, as well as in most of the other characters indicated above.

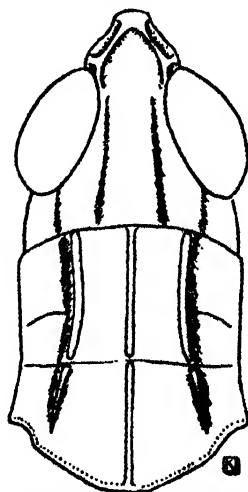
Total length, ♂ 17, ♀ 26; pronotum, ♂ 3.5, ♀ 5; elytra, ♂ 14, ♀ 20; hind femur, ♂ 10, ♀ 15 mm.

The type (male) is from Nahr-*ez-Zerka* river (flowing into Mediterranean Sea near Caesarea), 31. v. 1923 (*Dr. P. A. Buxton*). A long series of paratypes of both sexes

collected partly by Dr. Buxton and partly by Dr. F. Bodenheimer are from the following localities:—Kedeira, Kafrourieh, Benjamina, Chedera, Dschun, Emek, Rehoboth.

The new subspecies shows some relationship with *Ch. brauneri* Znoiko (*l. c.*) in the curved pronotal keels, but their curvature is quite different in the two insects. The venational characters indicate clearly that the Palestinian form is very closely allied to *Ch. dorsatus*, and I regard it as only a subspecies of *dorsatus*, although the shape of pronotal keels is such as to suggest an approach

Fig. 5.



Chorthippus dorsatus palastinus, subsp. n.

to the group of species with inflexed keels. This demonstrates only that the modern conception of the genus *Chorthippus*, as based on the characters other than the shape of pronotal keels, is perfectly sound, this shape often being not more than subspecific in value and, of course, not generic.

Ch. dorsatus palastinus has been recorded from Palestine under the name *Ch. albomarginatus* (see Buxton and Uvarov, Bull. Soc. Ent. Egypte, 1923, p. 186). The latter species must be excluded from the Palestinian list.

LXXIII.—On a new Species of Polychæte of the Genus *Pilargis* from Friday Harbour, Washington. By C. C. A. MONRO (British Museum).

INTRODUCTION.

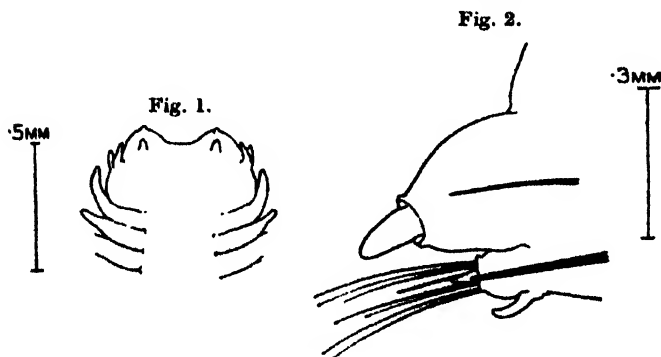
MRS. E. BERKELEY, of the Biological Station at Nanaimo, British Columbia, very kindly presented the specimen described in this paper. It belongs to the rare and aberrant Hesionid genus *Pilargis*, of which, to the best of my knowledge, only two species were previously known.

Family Hesionidæ.

Pilargis berkeleyi, sp. n. (Figs. 1-4.)

Occurrence.—Friday Harbour, Washington; one specimen.

Description.—The specimen is incomplete behind and measures 20 mm. by 2 mm. including the feet at the widest



Pilargis berkeleyi, sp. n.

Fig. 1.—Head from above.

Fig. 2.—Middle foot.

part for fifty-seven chaetigers. The body is flattened, deeply out into by the feet, and narrows markedly in front. It is colourless except for the bright brown dorsal lobes (cirrophores?) of the feet. This colouring is due to a granular inclusion in the dorsal lobes and does not appear before the fourth chaetiger. The back and feet are studded with small papillæ as in *P. verrucosa*. The

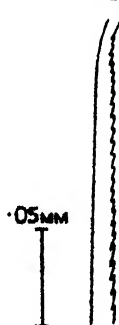
pharynx is partly everted, and appears to be membranous and globular. I see no jaws.

The head (fig. 1) is twice as broad as long and is without visible eyes. It ends in a pair of ovate palps, at the apex of one of which I can see a minute papilliform process which I take to be a palpostyle. There is a pair of small, blunt, lateral tentacles just behind the palps. I see no median tentacle. At the sides of the head there are two pairs of small, fusiform, tentacular cirri, pointing forwards. The dorsal tentacular cirri are longer than the

Fig. 3.



Fig. 4.



Pilargis berkeleyi, sp. n.

Fig. 3.—Capillary bristle.

Fig. 4.—Denticulated bristle.

ventral. They are situated at the sides of the head just behind the lateral tentacles, and whereas the segment to which they belong is complete ventrally and forms the hinder lip of the mouth, it completely disappears dorsally. The head is therefore pushed back into the buccal segment.

The first chaetiger lies close up against the tentacular segment, and the dorsal cirrus is fusiform, longer than the tentacular cirri, and clearly functions as a tentacular

cirrus. With the present material I cannot make out the ventral cirri of the first few chætigers.

The first three chætigers are colourless and have fusiform dorsal cirri. At the fourth chætiger the beginning of the enlargement of the dorsal lobe (cirrophore ?) of the foot is evident, and this increases from before backwards till about the tenth chætiger. A typical foot from the middle of the body (fig. 2) has this enormous dorsal lobe supported by a small colourless aciculum and surmounted by a small rather thickened cirrus. Below this is a rounded conical chæta-sac, and finally a small digitiform ventral cirrus. The bristles are of two kinds—long, fine, capillary bristles ending in a bifid hook (fig. 3), and much stouter and shorter bristles (fig. 4) with one edge denticulated and also ending in a bifid hook. I see no forked bristles.

Remarks.—Of this rare and curious genus two species only have, so far as I know, been described—the European *P. verrucosa* Saint Joseph, of which, according to Fauvel, *P. perezi* Charrier is a synonym, and *P. tardigrada* Webster from the Virginian coast. *P. verrucosa* (*P. perezi*) has been well figured by Charrier (Bull. Stat. Biol. Arcachon, xxi. 1924, p. 13, figs. 1 & 2), and the shape of the head in the present species is very similar to that of *P. verrucosa*, but *P. berkeleyi* is immediately distinguished both from Saint-Joseph's and Webster's species by the presence of the large dorsal lobes to the feet and of denticulated bristles.

Owing to the poverty of my material my description is not so complete as I should like to make it. I have named this species after Edith Berkeley, the author of many valuable contributions on the Polychæta of the Pacific Coast of North America.

LXXIV.—*The Coccidæ of New Caledonia.*

By F. LAING, M.A., B.Sc.

DURING his visit to New Caledonia in May and June 1923 Professor T. D. A. Cockerell collected a few species of Coccidæ, a list of which follows. The opportunity has been taken to include the description of what appears to be a new species collected by Dr. P. A. Buxton in 1925,

and also those previous records known to me, so that the list may be as complete as possible :—

- Eriococcus araucariae* Mack. : Dge, Uen, on *Araucaria*.
Pseudococcus boninsis Kuw. : Bourail, on sugar-cane.
Ferrisia virgata (Ckll.) : Mueo, on *Codiaeum*, *Lantana*, *Citrus*, and *Acalypha*.
Antonina littoralis Ckll. & Buek. : Bourail, on a grass.
Ceroplastes rubens, Mask. : Tontouta, on *Melaleuca* (P. A. Buxton).
Pulvinaria psidii Mask. : Plume Farm, on guava ; Bourail, on an unidentified plant and on coffee ; Ngo Bay, on an undetermined plant.
Eucalymnatus perforatus Newst. : Plume Farm, on *Cocos*.
Coccus elongatus (Sign.) : Bourail, on *Codiaeum*.
Pinnaspis minor (Mask.) : Bourail, on an orchid growing on an old *Agave* stump ; Plume Farm, on coconut.
Prontaspis citri (Comst.) : Bourail, on *Citrus*.
Fiorinia floriniae T. T. : Plume Farm, on coconut.
[*Fiorinia neo-caledonica* Ldgr. : on *Baekia pinifolia* (Lindinger, Zeitschr. f. wiss. Insektenbiol. vii. p. 176, 1911).]
Aspidiotus hederæ Vall. : Dge, Uen, on *Cocos nucifera*.
The third pair of pygidial lobes are more sharply pointed than is usual in this species, but the same character may be found in material collected in other parts of the world.
Chrysomphalus ficus (Ashm.) : Noumea, on *Pandanus* ; Tontouta, on coconut (P. A. Buxton).
Pseudaonidia trilobitiformis (Green) : Mueo, on oleander and *Ficus* sp. ; Noumea, on *Codiaeum*.
[*Aonidia longa* Ldgr. : on *Podocarpus gnidioides* (Lindinger, Zeitschr. f. wiss. Insektenbiol. vii. p. 172, 1911).]

Aonidia buxtoni, sp. n.

Puparium subcircular, highly convex, warm reddish brown ; diameter 0.57 mm.

Early stage ♀ of normal pyriform shape, with numerous rather strong setæ on the cephalic region and around the margin. Antennæ consisting of a low broad tubercle, with a shoulder before the apex, from which arises a fairly strong seta. On the fronto-lateral margin, on each side, is a row of five or six papillæ ; at intervals



B Hopkins

Aonidia burtoni Laing, sp. n.

A. Pygidium of adult ♀. B. Pygidium of second stage ♀

around the margin, beginning slightly anterior to the front spiracles, are tubular ducts. Pygidium with three pairs of lobes; median pair notched on both the inner and outer margin, rather long and narrow; second pair may or may not be notched on inner margin, but twice notched on the outer; third pair with a straight inner margin and double-notched on the outer; the usual pair of squamæ in the median and first lateral incisions, three in the second, and three beyond the third pair of lobes; immediately beyond the last squama the margin is produced into a triangulate prominence, the margin of which is serrated and has a seta at the middle; a seta at the outer angle of each lobe. Length 0.46 mm.; breadth 0.34 mm.

Adult ♀ as broad as long, more or less circular, with the pygidium produced behind. Surface devoid of setæ. Antennæ consisting of minute tubercles, with a single, longish, curved seta. Parastigmatic pores absent. Rostral apparatus well developed. Abdominal segments well marked. Pygidium with the margin produced into seven long finger-like processes, the median one and the first lateral pair bifid for nearly their whole length, the others divided into three; a strong seta in the second and third interstices and another immediately beyond the last, and two small median ones lying posterior to the anal orifice. Length subequal to the breadth, 0.5 mm.

Tontouta, vi. 1925, on Switch grass (*P. A. Buxton*).

This species bears some relationship to *A. viridis* Ldgr. and *A. javanensis* Green, for both have five long finger-like processes; in *A. viridis* the three median processes are bifid and the outermost divided into three; in *A. javanensis* the second lateral pair of processes is entire.

LXXV.—*Descriptions and Records of Bees*.—CXLIV.

By T. D. A. COCKERELL, University of Colorado.

Celioxys orthura, sp. n.

♀.—Length about 10.6 mm.

Black, with pure white hair; mandibles obscurely reddish in middle; antennæ and tegulæ black; tarsi rufescent, with orange-fulvous hair on inner side, but

white on outer; eyes dark brown, with short hair; clypeus ordinary; face broad, covered with white hair, appearing greyish on clypeus and above, but dense and pure white at sides of face, and at least halfway up front; a shining space in middle between ocelli; vertex with scattered scale-like hairs: cheeks entirely densely covered with white hair; mesothorax shining, with numerous large punctures; anteriorly it has two large white spots; the anterior and posterior corners are densely covered with white hair, connected by a line over tegulae; two brilliant white lanceolate spots at base of scutellum, and narrow marks on margin of mesothorax adjacent; tegulae with a white spot in front; scutellum entirely dull, angulate behind, the posterior margin with scale-like hairs; axillae with long slender flattened spines, appearing obtuse in lateral view. Wings rather dilute fuliginous, hyaline at base; basal nervure almost reaching nervulus; recurrent nervures joining second cubital rather (but not very) near base and apex. Legs with dense white hair on outer side. Abdomen shining, not very densely punctured, with five entire pure white hair-bands, which are broadened laterally (but there are no separate spots), the first connected with a broad band along sides of tergite; sixth tergite with a large white spot on each side; apex elongate but not greatly produced, the tergite slightly broader than the sternite, its apical portion entirely dull and weakly keeled, the apex rather narrowly rounded; last sternite straight (not directed downward), simple at end, going a short distance beyond the tergite, not notched at sides; venter with four white hair-bands, the first three very broad, the fourth V-like.

S. Rhodesia: Beit Bridge, April 12, 1932 (*J. O.*).

This has exactly the aspect of *C. somalina* Magretti, from Chiromo, Nyasaland, but is very easily separated by the angulate scutellum and the form of the axillar spines. The apex of the abdomen in lateral view is like that of *C. rufescens* Lep., with the dorsal outline of the sixth tergite concave, but the end of the tergite is not so slender. *C. chubbi* Ckll. is much larger, and the scutellar marks are in the form of short bands, not spots, and the axillar spines are much stouter. In *C. chubbi* the sixth tergite has a keel down its whole length; in

C. orthura the basal portion of the tergite is shining, wholly without a keel.

Mesotrichia heterotricha, sp. n.

♀.—Length about 14.7 mm., anterior wing 13, width of vertex 3.3, width of abdomen 6.2.

Face with mixed black and greyish-white hair, the general effect dark; vortex with black hair; cheeks with long white hair, but also a good deal of black; thorax above and first tergite with bright canary-yellow hair, not mixed with black; mesopleura with black hair, but a large tuft of pale yellow below wings. Legs black, with black hair, some glittering pale hairs on anterior tibiae behind; flagellum obscure red beneath. Wings brown throughout, with a rose-purple lustre; a few red hairs at extreme tip of abdomen.

Related to *M. sciensis* Gribodo (*anicula* Vachal), but smaller, with hair of face largely black (densely covered with white hair in *sciensis*). It is, perhaps, to be regarded as a southern race of the tropical *M. modesta* (Smith).

Cape Province: Huguenot, Feb. 5–10 (*L. O.*) *.

Mesotrichia somalica (Magretti).

S. Rhodesia: Christmas Pass, Umtali, May 20–21 (*A. M.*, *J. O.*).

I determine this principally from the description of Vachal, who had a typical (Somali) specimen from Magretti. Width of vertex about 4 mm., of abdomen fully 9; anterior wing 15.2 mm., distance between wings about 8. I must agree with Vachal that if this is not a good species it is a variety or race of *M. caffra*, not of *M. flavobicincta* (Gribodo), as Friese has it. Vachal says it also occurs in Madagascar, where I suppose it must have been introduced with timber. The differences from *M. caffra* are such that they might have arisen more than once, but at present we must refer to *M. somalica*.

* I have since found in the collection a male of *M. heterotricha*, collected at Ceres, C.P., Feb. 12–18 (*J. O.*). It resembles other males of this group, but has no median stripe on clypeus, though there is a slender apical yellow band. Compared with the male of *M. caffra* Enderl. it is more slender, with the pale yellowish hair on abdomen much longer, and the mandibles at base with a minute yellow dot, instead of a large spot. The flagellum is deep ferruginous beneath, and the hind tarsi have pale hair on outer side. Wings hyaline, brownish apically; anterior wings 12 mm. long.

those specimens, northern or southern, which appear to possess the necessary characters. Vachal suggested that *M. suspiciosa* (Vachal) might be the male, but it is too small.

Female *M. caffra* (L.) was collected at Huguenot, C.P., Feb. 5-10 (L. O.), and male of the same at Ceres, C.P., Feb. 12-18 (J. O.). But from Vumba, Umtali, S. Rhodes a (J. O., L. O.), are six males which I can by no means distinguish from *M. caffra*. Are they, nevertheless, the males of *M. somalica*?

Mesotrichia caffrariae (Enderlein).

S. Rhodesia: Christmas Pass, Umtali, May 20-21 (J. O.).

This female agrees with the description, except that the legs are black instead of reddish brown. It is so close to *M. senior* (Vachal) that perhaps it is no more than a southern race. *M. mixta genuina* (Vachal) was also taken at Christmas Pass, May 20 21 (A. M.).

Xylocopa tenkeana, sp. n.

♀.—Length 15.5 mm.; anterior wing 13, width of abdomen 6.5.

Black, with black hair, except that there is much bright red hair on middle and hind legs, covering entire outer side of middle basitarsi, all of hind tarsi except apical portion, apical half of hind tibiae, and extending narrowly almost to base on outer side; process of hind tibia briefly bidentate, placed well beyond the middle; flagellum dark, very faintly brownish beneath; clypeus with a delicate median carina and an obtuse swelling at each side; clypeal margin rather broadly polished, with a small median tubercle above the polished band, and at sides with oblique punctiferous striae; tegulae pure black. Wings dark fuliginous, brilliant rosy violaceous in middle, the apical field steel-blue, only the base of wings somewhat paler.

In all respects very close to *X. wellmani* (*X. tarsata wellmani* Ckll.), but that differs by the golden-green wings, the basal half pale; the sides of apex of clypeus punctured, not striate; the flagellum paler beneath; the abdomen more weakly punctured.

Belgian Congo : Tenke (or N'Tenke), July 30–Aug. 9 (J. O., A. M.).

Following Smith's brief description I should have been disposed to refer this to *X. tarsata* Smith. The true *X. tarsata* is, however, a species of the Cape region; the type is at Oxford, but a specimen compared with the type by Meade-Waldo is in the British Museum. I noted of this specimen: "Resembles *X. gaullei* Vachal in appearance, but larger (anterior wing 16 mm.), and lacks the vertical grooves or elongated punctures on marginal area of clypeus at each side of median tubercle; also abdomen less closely punctured." The name *X. tarsata* has been used in too wide a sense; thus a female so-named by Gribodo, from Saganeiti, proves to be *X. gaullei* Vachal. *X. gaullei* was taken in the Belgian Congo at Tshibinda (W. P. C.). *X. angolensis* var. *neavei* Strand seems to be *X. wellmani*.

Xylocopa erythrina Gribodo.

S. Rhodesia : Vumba, Umtali, May 23–26 (L. O., J. O.). It is interesting to find this species so far south; it was described from Saganeiti, Eritrea. Our specimens are rather more robust than northern ones, but do not belong to the race *fulleborni* Enderlein, described from Lake Nyassa.

X. fraudulenta Gribodo was also taken at Vumba (J. O.).

Xylocopa fraterna Vachal.

F. Smith, in 1874, described *X. producta* male and *X. carinata* female from Angola. As Smith himself surmised, these are to be considered sexes of one species. The name *producta* has page-priority, but the species is generally called *X. carinata*.

A male before me, from Kyambu (A. E. Dent), agrees with the description of *X. producta*, and is so referred. It has a long spine on the hind trochanter. I examined Smith's type of *producta* in the British Museum, and noted the spine on hind trochanter; also the dull orange face, the lateral marks not extending above level of antennæ.

Vachal, in 1899, described *X. fraterna* from Delagoa Bay. It resembles *producta*, but the hair of thorax above is whitish or greyish throughout, and the wings

are mainly hyaline, with the broad apical field dilute brown. I recorded this form from Durban in 'Annals Durban Museum,' April 1916, p. 189. On re-examining the Durban specimen I find that the hind trochanters have only a tubercle, instead of a spine as in Strand's differently coloured *X. carinata* var. *usambarensis* (1911). The hind femora have a stout oblique spine near the base. This condition also exists in what I have identified as *X. carinata* var. *fulvopilosa* Friese, 1909, from Natal, and recently from Kahe, Usambara, British E. Africa (*T. J. Anderson*). Friese's original *fulvopilosa*, said to have the thorax and base of abdomen fulvous-haired, came from the Cameroons and Togo; so, although we have no evidence on the point, it is possible that it has the trochanter spined. I conclude that we must consider *X. fraterna* a valid species, with a race *usambarensis* (Strand), and *fulvopilosa* must go with this species unless an examination of the types shows otherwise. Friese, in 1922, gives a fuller description of *fulvopilosa*, as if it were new, and this agrees with my specimens.

The following species, males with the hair of legs black and the face shining (as if oily) yellow or orange, cannot be identified with any described, and must be regarded as additions to an already complex and difficult group of species :—

Xylocopa euzantha, sp. n.

♂.—Length about 18 mm., anterior wing about or nearly 13, width of abdomen 8.

Black, the flagellum dusky red beneath except basally; face below antennæ shining lemon-yellow, the supra-oclypeal mark broadly emarginate above, the lateral marks going a short distance above level of antennæ (as in *X. pusulata* Vachal); labrum and mandibles entirely black; clypeus with scattered but very distinct punctures (in *pusulata* almost entirely impunctate), smooth in middle, the upper part with a very delicate keel; vertex with a curved band passing behind ocelli, the lateral portions almost entirely impunctate; hair of head and thorax scanty, mostly black; a band of short brown hair on postscutellum, with whitish hair in front of it, a little pale hair above tegulæ, and hair

of mesopleura partly pale; a little tuft of white hair below each tegula anteriorly; mesothorax with large punctures, scattered in middle; scutellum with smaller punctures; tegulae slightly reddened externally. Wings reddish hyaline, with a deeper suffusion along the veins, and with rosy iridescence; first recurrent nervure meeting second intercubitus, second recurrent joining third cubital cell before the beginning of its last third (the venational characters exclude *X. rejecta* Vachal). Hind trochanters not spined; hind femora very robust, strongly punctured, with a small basal tooth; hind basitarsi in some lights showing a line of coppery-red hair on inner side. Abdomen shining, well punctured; apex with much black hair.

Belgian Congo: Dilolo, July 24-27 (*W. P. C.*).

Close to *X. pusulata* Vachal, and perhaps no more than a local race, with darker hair and well-punctured clypeus. Females ascribed to *X. pusulata* were common at Dilolo, and presumably the present insect belongs with them.

Xylocopa euxantha var. *euchrysea*, nov.

♂.—Similar, but face orange; clypeus well punctured, but with a broad smooth band down middle and no trace of a keel; mesothorax anteriorly with thin light grey hair and mesopleura with conspicuous whitish or brownish hair; first tergite with variable light hair at sides; hind trochanters very obtusely angulate; hind femora with a strong basal tooth and the lower margin conspicuously angulate. In *X. euxantha* proper the hind femora, seen from in front, appear to be wholly devoid of a tooth; the tooth is larger and more conspicuous in *euchrysea*, but in some positions it seems to be absent.

Belgian Congo: Dilolo, two, July 26-27 (*W. P. Cockerell*).

I thought at first that this might be a distinct species, but it is clearly only a variation. *X. angolensis* Smith has a similar appearance, but the legs are quite different.

Xylocopa sudanica, sp. n.

♂.—Length about 23 mm., anterior wing 18.4.

Entirely black, with mainly black hair (all black on legs), but face with dull white hair mixed with black

(very conspicuous on clypeus when seen from above), a very little pale hair at middle of occiput (but black on cheeks), mesothorax anteriorly with a transverse band of dull white hair (but brownish-black hair before that), and a bright patch of white hair in middle of mesopleura; antennæ black, third joint not as long as 4 + 5, joint 5 considerably longer than 4; clypeus dull, with a shining median ridge and lower margin; frontal keel very poorly developed, ending at level of antennæ; width of face in middle 3 mm.; tegulæ black. Wings dark fuliginous, with a pale base as in *X. fenestrata* Fab.; the wings are purple-blue with greenish tints, the broad apical field rosy purple; disc of mesothorax with the punctures weak and widely scattered; the pair of small tubercles on outer side of hind tibia a little before the middle. Abdomen rather long and narrow; first tergite almost impunctate in middle; third tergite at sides with a little rounded tubercle, followed by a broad oval depression, which in certain lights shines with short copper-red pubescence; apex obtusely bidentate and with much black hair. The first recurrent nervure meets intercubitus; the second reaches third cubital cell before the middle and midway between base and the morphological lower apical corner (distinctly beyond midway in *X. taschenbergi* Vachal and *X. fenestrata*). The abdomen is much more like that of *X. taschenbergi* than that of *X. hollentota* Smith, but the tufts are much more confluent and indistinct, and the long pencils of hair which stand out on each side of the apex in *X. taschenbergi* are absent. The punctures of the scutellum are smaller than in *X. taschenbergi*. Compared with *X. fenestrata* the face is broader and the blade of maxilla is shorter, while the anterior wings are smaller and narrower.

Sudan: Shendi, in garden, July 7, 1923 (*W. E. Giffard*).

Also labelled "Berber, 811," and "Ent. Coll. C. 4777."
From Imperial Institute of Entomology.

Xylocopa gribodoi Magretti.

British E. Africa: no special locality given (*T. J. Anderson*).

It is larger than the type (♀), about 23 mm. long, anterior wing 19.

A similar specimen in the British Museum is from Narossura River, Brit. E. Africa. Superficially it looks like *X. buyssoui* Vachal, but it is larger, and the frontal keel is only half as long.

LXXVI.—*Coléoptères nouveaux*. Par M. Pic.

LES nouveautés ci-dessous décrites font partie des collections du British Museum, mais je possède un co-type de *Perakianus multistriatus*.

Ichthyurus woodi, sp. n.

Elongatus, nitidus, testaceo-aurantiacus, capite postice late, pectore pro parte, pygidio membrisque pro parte nigris, abdomine infra pro parte et reducte piceo notato. Capite nitidissimo, postice et medio late excavato ♂, latiore, subnitido, postice paulo et transverse impresso ♀; antennis nigris, ad basin testaceis; thorace non transverso, in ♀ latiore; elytris sat brevibus, postice longe dehiscentibus, apice paulo plicatis; pygidio nigro, in mare longiore, angustiore et apice longe inciso, in femine lato et apice subtriangulariter inciso; pedibus gracilibus, ♀, nigris, femoribus ad basin testaceis; pedibus antice et postice ♂ gracilibus, late nigris, femoribus intermediis testaceis, validis, difformibus, dilatatis et curvatis, infra postice excavatis, apice incisitis et bilobatis, lobo interne subangulato, externe longiore et curvato, vibiis nigris, gracilibus. Long. 8-9 mm.

Espèce très distincte par sa coloration en grande partie orangée et la structure des pattes intermédiaires du ♂, celle-ci rapproche *I. woodi* mihi de *I. favareli* Pic qui a les élytres et le prothorax marqués de noir.

NYASALAND: Cholo (*R. C. Wood*).

Metholcus dilatatithorax, sp. n.

Elongatus, parum nitidus, breviter griseo aut luteo pubescens infra pro parte densiore vestito, rufo-brunnescens; antennis testaceis. Capite robusto, sat dense granuloso, oculis nigris validis; antennis elongatis, articulo 2° brevi, 3° elongato, subtriangulari, 4° et sequentibus apice angulatis, tribus ultimis angustioribus et longioribus; thorace brevi et latissimo, elytris latiore, lateraliter fere recto, angulis posticis nullis, rotundatis, lateraliter antice minute

et postice latius impresso, supra medio, et postice inæqualiter, sat dense granuloso; elytris elongatis, postice attenuatis, regulariter striato-punctatis, striis postice pro parte junctis aut oblique dispositis, intervallis subconvexis; pedibus sat gracilibus.

Long. 11 mm.

Espèce (quoique représentée par une seule ♀) très particulière, bien distincte des espèces connues, par la forme du prothorax et les élytres nettement et régulièrement striés.

NATAL: Weenen (H. P. Thomasset).

Ptilinus longipennis, sp. n.

Angustatus, subnitidus, minutissime griseo-holosericco pubescens, rufo-brunneus, pro parte piceus, antennis testaceis, his pro majore parte pectinatis, articulo ultimo elongato. Capite robusto, dense granuloso, oculis magnis; thorace sat lato, antice medio attenuato, lateraliter postice sub-sinuato, dense punctato-ruguloso, pro parte medio et antice granuloso, medio longitudinaliter sulcatulo; elytris thorace non latoribus, elongatis et angustatis, apice valde attenuatis, minutissime punctatis, instriatis.

Long. 5 mm.

Diffère de *P. truncaticeps* Pic, par la forme plus étroite, le prothorax orné de granules et moins robuste, les élytres plus rétrécis à l'apex.

N. RHODESIA: Congo-Zambesi watershed (Dr. H. S. Evans).

Ptinus incisicollis, sp. n.

Oblongus, parum nitidus, rufescens, capite, infra corpore pedibusque dense albo-pubescentibus, elytris longe et hirsute luteo-pilosis, ad basim sat late albo-squamulatis. Antennis sat validis; thorace sat breve, non transverso, medio postice distincte inciso et bigibbuloso, parum pubescente, lateraliter non tuberculato, late granuloso; scutello minute, dense albo-pubescente; elytris thorace valde latoribus, brevibus, apice oblique attenuatis et paulo-marginatis, sat fortiter striato-punctatis, striis postice pro parte oblitteratis.

Long. 3 mm.

Voisin de *P. maculifer* Pic, en diffère nettement par la structure du prothorax et les élytres plus courts;

diffère, en outre, de *P. dilaticornis* Pic par le prothorax particulier avec les élytres sans partie apicale explanée.

UGANDA : Kampala (*G. L. R. Hancock*).

Perakianus multistriatus, sp. n.

Angustatus, nitidus, minute griseo aut fulvo pubescens, ater, labro pro parte testaceo. Capite dense punctato, inter oculos diverse impresso; antennis deplanatis, articulo 3 et sequentibus plus minusve latis; articulo secundo palparum elongato, 3^e transverso, 4^e fere cultriforme; thorace parum elongato, lateraliter fere recto, antice non marginato densissime punctato, postice minute biimpresso; elytris thorace non latoribus, elongatis, postice attenuatis, fortiter striatis, striis apice diverse oblitteratis, intervallis convexis, dense punctatis, sat plicatis; pedibus parum gracilibus, spinis tibiarum testaceis, interna longior.

Long. 10-12 mm.

Se rapproche par sa coloration de *P. 4-costatus* Champ. (ex figure), mais prothorax entièrement noir, élytres moins longs et nettement striés.

N. NIGERIA : Azare (*Dr. L. Lloyd*).

Rhipidius laticollis var. nov. *marginalis*.

Parum nitidus, griseo pubescens et hirsutis, niger, elytris apice albo marginatis; ramulis antennarum ad basim rufo-brunneis; thorace parum brevi, antice valde attenuato, medio subcarinato.

Long. 4-50 mm.

Diffère, à première vue, de *R. laticollis* par le prothorax moins transversal et la coloration plus foncée des élytres.

N. RHODESIA : Congo-Zambesi watershed (*Dr. H. S. Evans*).

Spermophagus albosuturalis, sp. n.

Brevis et latus, nitidus, niger infra corpore et pygidio uniformiter griseo-pubescentibus, supra signaturis albo-argenteis ornatus, membris nigris, spinis tibiarum testaceis. Antennis elongatis, filiformibus parum crassis; thorace brevi et lato, antice attenuato, diverse et dense punctato, nigro, ad basim et lateraliter latiore argenteo marginato; scutello minuto, albo-pubescente; elytris latis et brevibus, striatis, intervallis punctatis, nigris, ad medium externe albo-argenteo maculatis, ad suturam albo-argenteo vittatis, vitta postice dilatata et ante apicem terminata.

Long. 2 mm.

Se rapproche de *S. babaulti* Pic avec les dessins du dessus du corps différents et caractérisé, à première vue, par la ligne suturale de pubescence blanche élargie en arrière.

N. RHODESIA : Congo-Zambesi watershed (Dr. H. S. Evans).

LXXVII.—A Note on the Subgenus *Syrdenus* Chaud.

(Coleoptera, Carabidæ). By V. LUTSHNIK.

SYRDENUS was founded by Baron de Chaudoir * as a distinct genus with four species : *S. filiformis* Dej., *S. extensus* Chaud., *S. grayi* Woll., and *S. fulvus* Baudi. Later on the majority of authors regarded this group as a subgenus of *Pogonus* Nic., but Mr. A. Semenov-Tian-Shansky † treats *Syrdenus*, quite correctly, as a subgenus of *Pogonistes* Chaud., the latter having full generic value. At present *Syrdenus* consists of two species, *P. filiformis* and *P. grayi*, and, as synonyms of the last-named species, *P. fulvus*, *P. extensus*, and *P. dilutus*.

Consideration and study of the material of several museums justify me in thinking that this is incorrect. In reality, *Pogonistes grayi* differs very much from *P. filiformis* in some particulars, and must be separated from it and placed in a distinct subgenus of *Pogonistes*. On the other hand, *P. extensus* must be assumed to have full specific value. Therefore I accept the subgenus *Syrdenus*, but with new and stricter limits.

Subgenus *SYRDENUS* Chaud.

The body is elongated, convex, with more or less parallel sides, and with a visible metallic lustre. The head is wide, with long mandibles, the supraocular prominences turning up gradually on the external side and forming a large blade with a blunt apex. Antennæ at the apex evidently enlarged. Prothorax with a seta before the middle and another in the posterior angles, but none in the anterior angles. Elytra with the microsculpture obsolete on the disk, more visible on the apex.

Type. *Pogonistes filiformis* Dej.

* Chaudoir, M., Ann. Soc. Entom. Belg. xiv. 1870, p. 22.

† Semenov, A., Horæ Soc. Entom. Ross. xxxiv. 1900, p. 579.

Two species of this subgenus may be tabulated as follows :—

- 1 (2). Dark piceous red with an intense greenish lustre. Head with large prominent eyes. Prothorax wider than the head with the eyes, not less than 1.2 times wider than long, widest before the middle, hardly more contracted behind than in front, median line fine, basal foveæ moderately deep. Elytra almost as broad as thorax. Length 5-6.5 mm. *P. filiformis* Dej.
- 2 (1). Red-brown with a very faint greenish lustre. Eyes less prominent. Prothorax not so wide as the head with the eyes, as long as wide, widest just behind the apex, more contracted at the base than in front, basal foveæ less deep, median line deeper. Elytra visibly narrower than the thorax. Length 4.5-5.5 mm. *P. extensus* Chaud.

Pogonistes filiformis Dej.

I have this well-known species only from Sardinia and N. Africa. Mr. E. Reitter mentions Southern France and Spain * as additional localities, but I think that these indications are erroneous.

Pogonistes extensus Chaud.

This species was described from the Egyptian coast of the Red Sea, probably from Suez. P. de la Brûlerie †, without explanation, placed *P. extensus* in synonymy with *P. grayi* Woll. By the kindness of Mr. G. Arrow I was able to examine a specimen in the British Museum from Port Said and an example of *P. grayi* from the same locality. The two species are quite distinct.

Pogonistes grayi Woll., as a species widely separated from *P. filiformis* and *P. extensus*, must be placed in a new subgenus :—

Subgenus *SYRDENOPSIS* n.

Body less parallel, faintly convex, without metallic lustre. Supracocular prominences strongly raised, acute at apex. Prothorax with setæ not only in the middle and at the posterior angle, but also in the anterior angle. Elytra with an obsolete isodiametric microsculpture.

Type. *Pogonistes grayi* Woll.

* Reitter, E., Verhandl. d. naturf. Ver. in Brünn, xlv. 1908, p. 5.

† Piochard de la Brûlerie, Ann. Soc. Entom. France, 1875, p. 432.

INDEX to VOL. XI.

- ACANTHARCTIA**, new species of, 193.
Acronophlebia, new species of, 46.
Acrididae, new, 247, 468, 602.
Adocia, new species of, 237.
Aeger lœvis, notes on, 159.
Æolothrips, new species of, 649.
Aleyonidium gelatinosum, notes on, 255.
Allodape, new species of, 49.
Amastus, new species of, 574.
Amblystomus, new species of, 411.
Ammalo, new species of, 571.
Amphibia, notes on, 151.
Amsacta, new species of, 180.
Anaphothrips, new species of, 651.
Andrewes, H. E., on *Oriental Carabidae*, 99, 399.
Antaretia, new species of, 586.
Anthidiellum, new species of, 464.
Anthidium, new species of, 463.
Anthocoridae, new, 514.
Anthophora, new species of, 458.
Anthracoecaris, characters of the new genus, 562.
Aonidia, new species of, 676.
Arachnida, notes on, 279, 289, 509.
Arctiinae, new, 167.
Arnold, G., and **Scott**, H., on *Abyssinian Sphegidae* and *Psammocharidae*, 351.
Arrow, G. J., on new *Melolonthine* *Coleoptera* from Mexico, 145; on the genus *Uroxys*, 385.
Ascarophis, notes on, 111.
Aubertin, Miss D., on species of the genus *Orthellia*, 139.
Automolis, new species of, 170, 568.
Bagnall, R. S., on the *Thysanopterous* genus *Haplothrips*, 313; on *European Thysanoptera*, 647.
Barclay, E. N., on the Ichwee of *South-Central Africa*, 334.
Bather, F. A., a vote on some *Echinoderm* names, 166.
Baylis, H. A., on the *Nematode* genus *Ascarophis*, 111; on new species of the *Nematode* genus *Mermis*, 413; on *Nematodes* from *Malayan reptiles*, 615.
Beier, M., on two new species of *Cheliferinae*, 644.
Bembidion, new species of, 100, 412.
Bibliographical Notices, 164, 422, 518, 613.
Blair, K. G., on *Coleoptera* from the *Galapagos Archipelago*, 471.
Blote, H. C., on new *Pyrrhocoridae* in the *British Museum*, 588.
Bodenheimerella, characters of the new genus, 667.
Brachiopoda, notes on, 423; new, 519.
Brade-Buks, Dr. H. K., and the *Rev. Dr. S. G.*, on a rare *English centipede*, 228.
Brœstrup, F. W., on the taxonomic value of the subgenus *Lophomops*, 269.
Bristowe, W. S., notes on the biology of spiders, 279, 289, 509.
Brongersma, L. D., on a new gecko of the genus *Gymnodactylus* from *New Guinea*, 252.
Brough, J., on a new *Palaeoniscid* genus from *Madagascar*, 76.
Burton, M., on sponges from *Stil Bay*, *S. Africa*, 235.
Calidota, new subspecies of, 188.
Calleida, new species of, 399.
Calman, W. T., on a fossil crustacean from the *Lower Carboniferous*, 562.
Camallanus, new species of, 628.
Camponotus, new species of, 196.
Carabidae, new, 99, 399; note on, 689.
Conarus, new species of, 593.
Cerambycidae, new, 480.
Cestoda, new, 610.
Chaetocrolopa, characters of the new genus, 350.
Chiroptera, notes on, 269.
Cheliferinae, new, 644.
China, W. E., on a new genus and species of *Anthovoridae*, 514.
Chsenius, new species of, 101.
Chlanobia, new species of, 145.

- Chorthippus*, new subspecies of, 671.
Chrysomelidae, new, 484.
Cissura, new subspecies of, 172.
Coccidae, new, 675.
 Cockerell, T. D. A., on descriptions and records of bees, 49, 204, 372, 456, 678; on African bees of the genus *Cœlioxys*, 547.
Cœlioxys, new species of, 548, 678.
Cœlopa, new species of, 343.
Cœlopella, characters of the new genus, 348.
Cœlopidae, new, 339.
Cœlopinia, characters of the new genus, 350.
Cmlostoma, new species of, 474.
Coleoptera, new, 1, 145, 385, 471, 686, 689.
 Collenette, C. L., on new *Lymantriidae* in the British Museum, 33.
Compsea, new species of, 481.
Copepoda, new, 307.
Copridae, new, 385.
Courtesius, new species of, 506.
Crasodactylus, new species of, 103.
Cratothrips, new species of, 658.
Cretonotus, new species of, 181.
 Cresson, E. T., on new African species of the genus *Paralimna*, 24.
Crustacea, fossil, 562.
Crustacea Decapoda, 159.
Cryptocyclops, new species of, 310.
Curculionidae, new, 1, 485.
Cymindia, new species of, 108.
Dasychira, new species of, 38.
Dasycelopa, characters of the new genus, 348.
Delacampius, new species of, 588.
Dericorys, new species of, 247.
Diaphorognathus, characters of the new genus, 78.
Dioclinidus, new species of, 107.
Dindymus, new species of, 592.
Diplostomum, new species of, 302.
Diptera, new, 24, 128, 339; notes on, 58.
Doddiana, new species of, 135.
Donisthorpe, H., on new species of *Formicidae*, 194.
Dromius, new species of, 402.
Dysdercus, new species of, 599.
 Edwards, W. N., on *Osmundites* from Central Australia, 661.
Elysia, new species of, 573.
Endæus, new species of, 2.
Enochrus, new species of, 473.
Ephydriidae, new, 24.
Eremiaphila, new species of, 664.
Eriophyes, new species of, 202.
Estiguanes, new species of, 184.
Estola, new species of, 482.
Euchlanidia, new species of, 583.
Eucras, characters of the new genus, 10.
Euproctis, new species of, 34.
Euryophthalmus, new species of, 588.
Euscopus, new species of, 590.
 Faulkner, G. H., on the *Polyzoon* *Aleyonidium gelatinosum*, 255.
Forcepia, new species of, 240.
Formicidae, new, 194.
Gammarius zaddachi, notes on, 64.
 George, T. N., on the Classification of the *Spiriferidae*, 423.
Gersus, new species of, 485.
Glaucostola, new species of, 571.
 Gohar, N., on a new *Trematode* parasite of the dog, 302.
Gymnodactylus, new species of, 252.
 Hale, H. M., on *Tanaidacea* and *Isopoda* collected by the Great Barrier Reef Expedition, 1928-29, 557.
Haliclona, new species of, 238.
Halisodota, new species of, 173, 576.
Hansenius, new species of, 645.
Haplochermes, new species of, 644.
Haplothrips, new species of, 315.
Hemiptera, new, 514.
Heteroxora, new, 566.
Heterosomata, notes on, 214.
 Hills, E. S., on a primitive *Dipnoan* from the Middle Devonian rocks of New South Wales, 634.
Himatium, new species of, 13.
Hispinae, new, 605.
Histeridae, new, 475.
 Hopwood, A. T., on *Miocene* *Primates* from British East Africa, 96.
Hydrophilidae, new, 472.
Hymenoptera, new, 49, 204, 351, 372, 456, 547, 678.
Hyperthasma, new species of, 570.
Hypomerita, new species of, 567.
Ichthyurus, new species of, 686.
Idalus, new species of, 167.
Ilernodes, new subspecies of, 192.
 Inandar, N. B., on a new species of *Avian Cestode* from India, 610.
Ischnocampa, new species of, 172, 574.
Isopoda, new, 557.
Kaliocephalus, new species of, 623.
 Kimmins, D. E., on a new genus and species of *Myrmeleonidae*, 244.

- Kingdonella, characters of the new genus, 469.
- Lachnosterna, new species of, 148.
- Lang, F., on the Coccidae of New Caledonia, 675.
- Lepidocoleus kelleyanus, notes on, 162.
- Lepidoptera Heterocera, new, 33.
- Leroux, S. L., on a Trichostronygid parasitizing the yellow mungoosie, 222.
- Leurostenus, characters of the new genus, 14.
- Limnopithecus, characters of the new genus, 97.
- Listrochelus, new species of, 146.
- Lithobius borealis, notes on, 228.
- Lophomops, notes on, 269.
- Lowndes, A. G., on Copepods from the Rift Valley Lakes, 307.
- Lutshnik, V., note on the subgenus Syrdonus Chaud., 889.
- Lymantriidae, new, 33.
- Lyperosia exigua, notes on, 58.
- Machæridia, notes on, 162.
- Mackerras, I. M., on the taxonomy of Lyperosia exigua, 58.
- Malika, new species of, 610.
- Malloch, J. R., on the Tachinid genus Doddiana, 128; on the genus Coslopa Meigen, 339.
- Mammals, new, 96; notes on, 269, 334.
- Maoricoris, characters of the new genus, 514.
- Marbla, new species of, 37.
- Marshall, Sir Guy A. K., on new Curculionidae from the Belgian Congo, 1.
- Massee, A. M., on a new variety of Tarsonemid, 196; on a new species of gall-mite from South India, 201.
- Maulik, S., on new Argentine Hispine, 605.
- Megachile, new species of, 208, 374, 465.
- Megathrips, new species of, 659.
- Melolonthinae, new, 145.
- Mermis, new species of, 413.
- Mesotrichia, new species of, 456, 680.
- Metachroma, new species of, 484.
- Metholus, new species of, 686.
- Micrasema, notes on, 274.
- Migoplatia, new species of, 192.
- Miscellaneous, 166, 254.
- Monas, new species of, 585.
- Munro, C. C. A., on Polychæta from South Africa, 487; on a new Polychæte from Friday Harbour, 673.
- Morgania, new species of, 377.
- Mosely, M. E., on a collecting-trip in Switzerland, 87; on the Micrasema species (Trichoptera), 274; on the genus Pseudoleptocerus Ulmer, 537.
- Muscidae, notes on, 58.
- Myers, G. S., on a new Characid fish from the Lower Amazon, 604.
- Myriapoda, notes on, 228.
- Myrmeleonidae, new, 244.
- Myrmoplasta, new species of, 595.
- Nanophyes, new species of, 5.
- Neidaha, new species of, 193.
- Nematodes, notes on, 111; new, 222, 413, 615.
- Nereida, new, 492.
- Nodosaurus, notes on, 231.
- Nonispa, characters of the new genus, 606.
- Norman, J. R., notes on flatfishes, 214.
- Notogonidea, new species of, 353.
- Obituary Notice, 421.
- Ochthebius, new species of, 473.
- Oeneria, new species of, 47.
- Ocymyrmox, new species of, 195.
- Odontopus, new species of, 592.
- Omopluron, new species of, 99.
- Opharus, new species of, 173.
- Orthellia, new species of, 142.
- Orthoptera, new, 247, 468, 602, 663.
- Osmundites, notes on, 661.
- Oswaldoocruzia, new species of, 624.
- Oxythrips, new species of, 650.
- Pachycondyla, new species of, 194.
- Pajanja, new species of, 591.
- Palaeocorynus, new species of, 7.
- Palaeoniscida, new, 118.
- Palmer, R., on Gammarus zadachi from Essex, 64.
- Panagrus, characters of the new genus, 104.
- Paralimna, new species of, 25.
- Parker, H. W., on some Amphibians and reptiles from the Lesser Antilles, 151.
- Parrington, F. R., on the Cynodont reptile Thrinaxodon liorhinus, 16.
- Pasiphaë, new species of, 461.
- Pedonocæa, new species of, 479.
- Pelochyta, new species of, 172, 572.
- Perakianus, new species of, 688.
- Pericallia, new subspecies of, 185.
- Perinereis, new species of, 492.
- Phaeomolis, new species of, 566.

- Phryganoptera*, new species of, 188.
Physopelta, new species of, 589.
Physothrips, new species of, 653.
 Pic, M., Coléoptères nouveaux, 686.
Pilargis, new species of, 673.
Pisces, new, 76, 118, 604.
Polychæta, new, 487, 673.
Polyzoa, notes on, 255.
Porthesia, new species of, 33.
Proconsul, characters of the new genus, 98.
Productus, new species of, 523.
Protocœlopa, characters of the new genus, 345.
Prumala, new species of, 167, 566.
Psammochares, new species of, 365.
Pseudagenia, new species of, 360.
Pseudalus, new species of, 174.
Pseudimares, characters of the new genus, 244.
Pseudognathaphanus, new species of, 102.
Pseudoleptocerus, new species of, 539.
Pseudoscorpionidæ, new, 644.
Pteronisculus, characters of the new genus, 118.
Ptilinus, new species of, 687.
Ptinus, new species of, 687.
 Pulfrey, W., note on sponge-spicules from North Wales, 67.
Pycnarthrum, new species of, 487.
Pyritonoma, new species of, 74.
Pyrrhocoridæ, new, 588.
 Reed, F. R. Cowper, on some Upper Carboniferous Brachiopods from Brazil, 519.
Reptilia, notes on, 16, 151.
Rhacius, new species of, 480.
Rhodogastria, new species of, 192.
Robinsonia, new species of, 566.
 Rothschild, Lord, on new species and subspecies of Arctiinae, 167.
Saprinus, new species of, 475.
 Schaus, W., on new species of Heterocera in the National Museum, Washington, 566.
Scolytidæ, new, 487.
 Scott, H., see Arnold, G.
Scorapter, new species of, 204.
Secusio, new species of, 190.
Sciaractia, new species of, 187.
Serolis, new species of, 560.
 Siango, characters of the new genus, 596.
Spermophagus, new species of, 688.
Sphingonotus, new species of, 602.
Spilosoma, new species of, 174.
Spiriferidæ, classification of the, 423.
Spongida, new, 67, 235.
Stenarctia, new species of, 187.
Stonista, new species of, 608.
Stenohippus, new subspecies of, 666.
 Sternberg, C. M., on Troödon and the Nodosaurus, 231.
Stethaptrion, new species of, 604.
Stilboma, characters of the new genus, 409.
Stizus, new species of, 357.
Stomion, new species of, 478.
Suberites, new species of, 241.
Tachina, new, 128.
Tanaisidæ, new, 557.
Tarsonemid, new variety of, 198.
Tenebrionidæ, new, 477.
Tenuostrongylus, characters of the new genus, 223.
Teracotona, new species of, 189.
Tetralonia, new subspecies of, 372.
Thrinaxodon liorhinus, notes on, 16.
Thrips, new species of, 656.
Thyreopus, new species of, 355.
Thysanoptera, new, 313, 647.
Trematodes, new, 302.
Trichoptera, notes on, 274; new, 537.
Trichostrongylidæ, new, 222.
Trigonobaris, new species of, 12.
 Troödon, notes on, 231.
Turuptiana, new species of, 188.
Uroxys, new species of, 389.
 Uvarov, B. P., on three new species of the genus *Dericorys*, 247; on a new grasshopper from the Assam Himalayas, 468; on a new *Sphingonotus* from Morocco, 602; on new and little-known Orthoptera from Palestine, 633.
 White, E. I., on new Triassic Palæoniscids from Madagascar, 118.
 Withers, T. H., on the Decapod Crustacean *Æger lavis*, 159; on the Machæridian *Lepidocoleus kotleyanus*, 162.
Xenopithecus, characters of the new genus, 97.
Xylocopa, new species of, 681.
Zanclophorus, new species of, 616.
Zatrephes, new species of, 169.

END OF THE ELEVENTH VOLUME.

PRINTED BY TAYLOR AND FRANCIS,
 AND LION COURT, FLEET STREET.

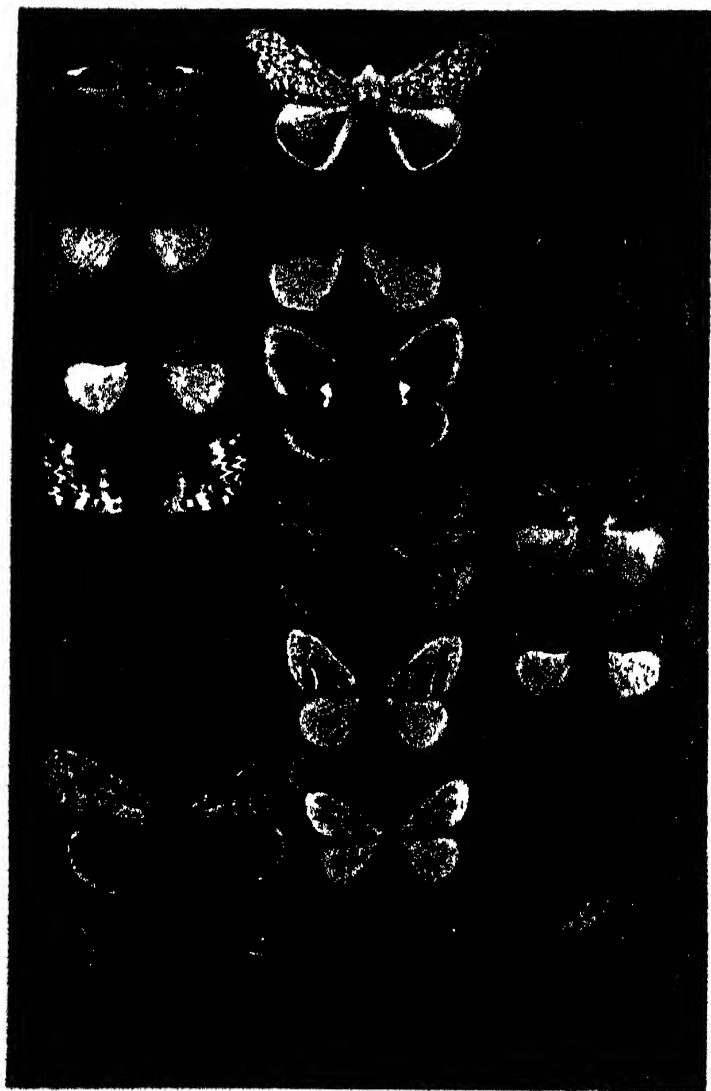


FIG. 1.

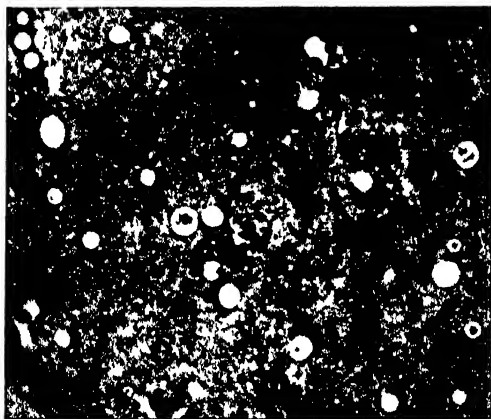


FIG. 2.



FIG. 3.



FIG. 4.



Spicules of *Pyritonema minuta* and *Reniera* (?).

BROUGH

Ann. & Mag. Nat. Hist. 8 10 Vol XI Pl III



1



2



3

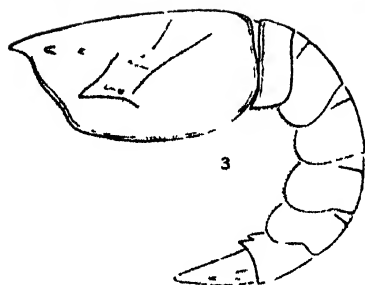


4

DIAPHOROGNATHUS GILLIOTI.



1



3



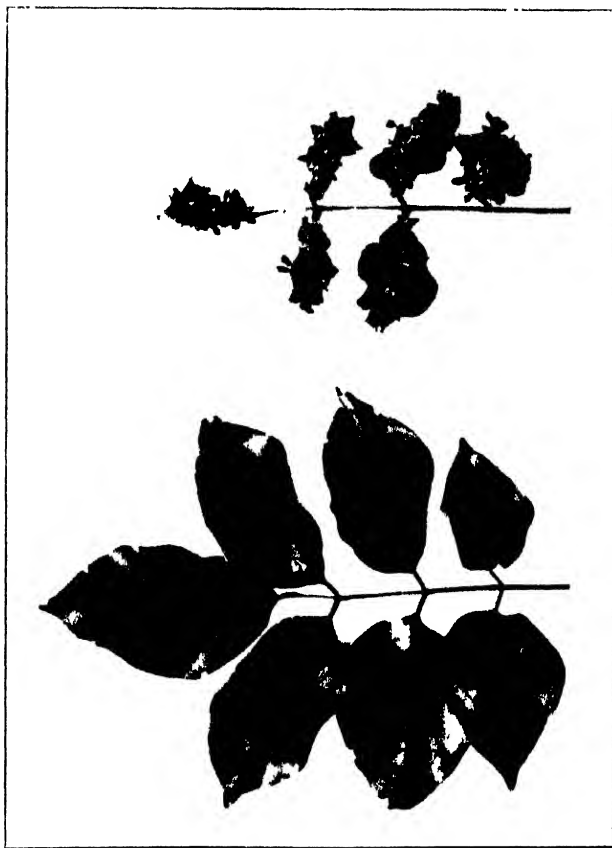
2.



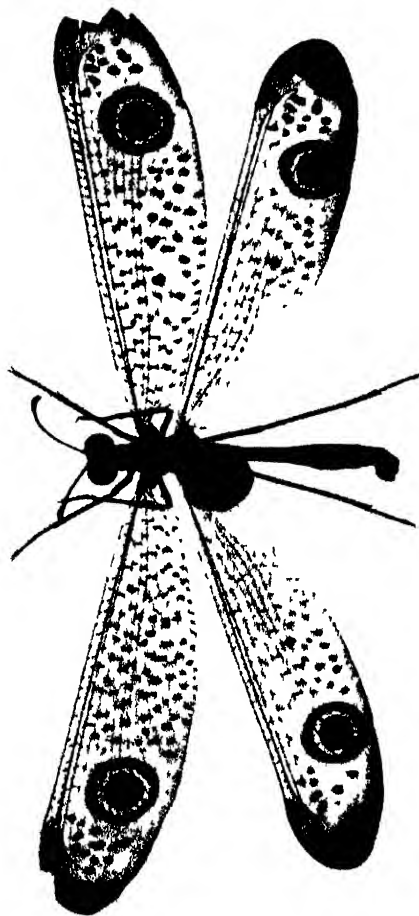
4.

HG Herring photo

AGER AND LEPIDOCOLEUS

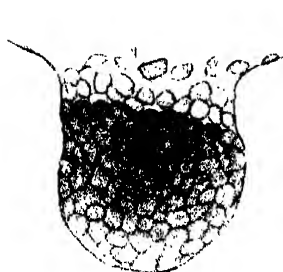


Pongamia glabra healthy and affected leaves

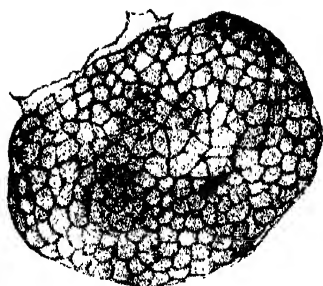


Pseudimares iris, sp. n. $\times 1\frac{1}{2}$

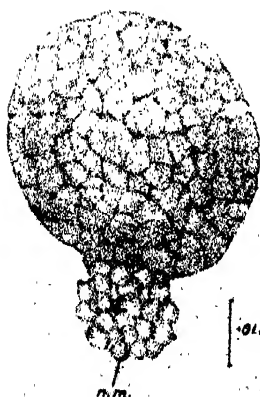
Photo H G Herrung



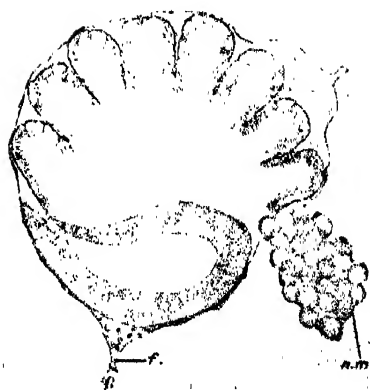
1.



2.



3.

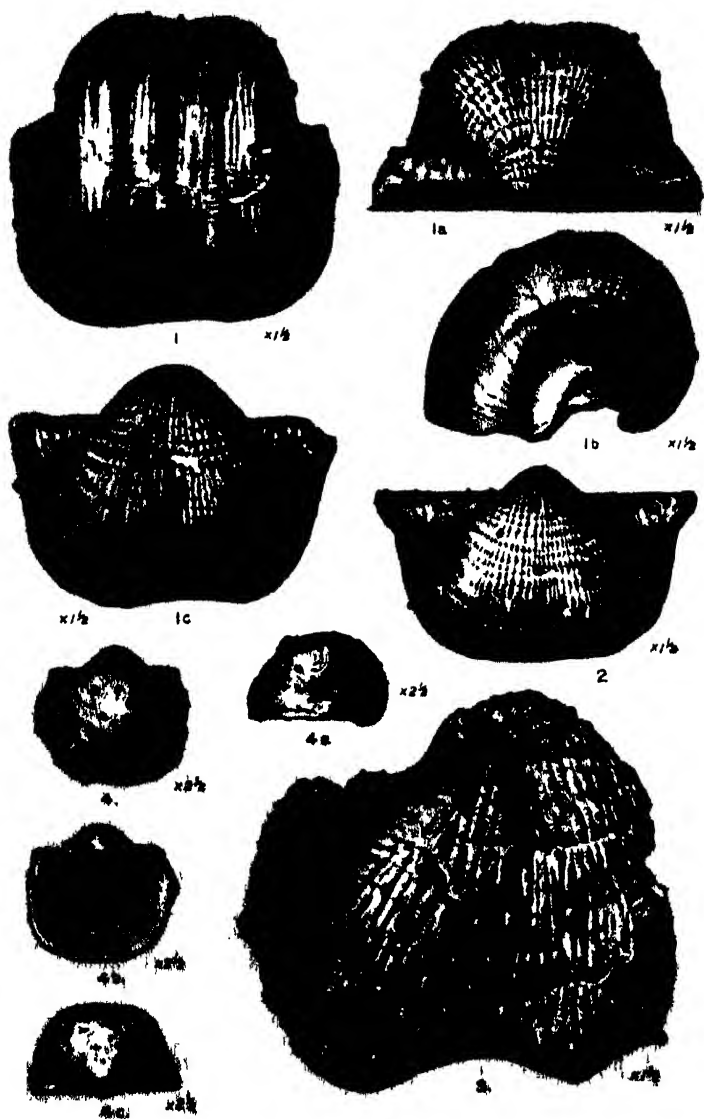


4.

ASEXUAL REPRODUCTION IN ALCYONIDIUM.



ASEXUAL REPRODUCTION IN ALCYONIDIUM



E. T. Tobols, del



FIG. 2



FIG. 1

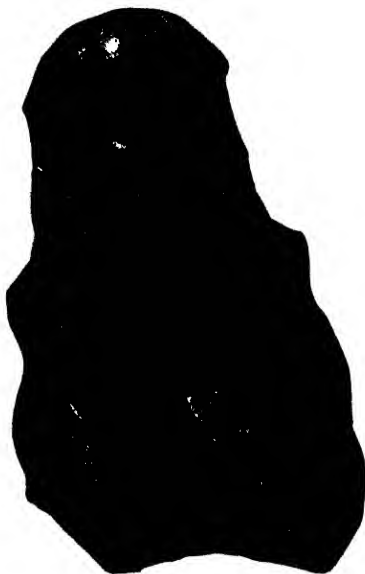


FIG. 3.

Photo M. E. M.

Anterior wing of *Pseudoleptocerus njalaensis*, sp. n.

MILLS

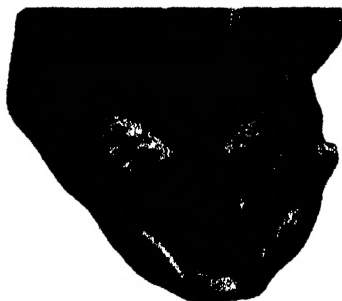


2.

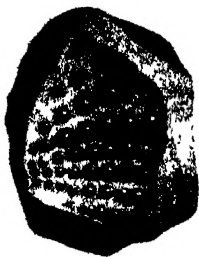
DIPNORHYNCHUS SÜSSMILCHI



1



2



3.



4.

1. & 2. EPICERATODUS FORSTERI.
 3. DIPTERUS TUBERCULATUS.
 4. DIPNORHYNCHUS SÜSSMILCHI.

L. A. B. I. 75*

IMPERIAL AGRICULTURAL RESEARCH
INSTITUTE LIBRARY
NEW DELHI.

Date of issue.	Date of issue.	Date of issue.
17.5.43		
18.7.47		
18.2.52	18.2.52	